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SEPTEMBER, 1856.

CIVIL ENGINEERING.

*On the Improvement of Railway Locomotive Stock and the reduction of the Working Expenses.** By DANIEL KINNEAR CLARK, Assoc. Inst Civ. Eng.

[Read before the Insitution of Civil Engineers, May 20th, 1856.]

It was stated that the design of the paper was to discuss the locomotive engine physiologically; to consider some departments of practice which appeared to be in a transition state; to endeavor to indicate how far, in some respects, the locomotive, even in its present advanced state of existence, was susceptible of improvement, and to form some estimate of the pecuniary advantages thus derivable. The three elements of the locomotive—the boiler, the engine, and the carriage—were considered successively.

With respect to the boiler, the fuels in use in this country were stated to be coke and coal. The author had in a previous paper, shown by mechanical analysis, that the combustion of coke in the locomotive was practically complete; and he adduced in corroboration, the results of a subsequent chemical analysis of the gases of combustion, by M. Ebelmen, in the engines of the Paris and Lyons Railway. In the combustion of coal, which consisted chiefly of carbon and hydrogen, the production of smoke was ascribed to the presence of the hydrogen, which had a stronger affinity for oxygen than carbon had, and thus precipitated the carbon particles raised in union with it in the form of smoke; and it was maintained that, to effect the consumption or prevention of smoke, two conditions of supply must be observed,—a suffi-

* From Newton's Lond. Journ., July, 1856.

ciency of oxygen, and a sufficiently high temperature. For these conditions it was argued that, in locomotive practice, strength of draft, and a means of equalizing the temperature were necessary to neutralize the evil of intermittent firing, and the unavoidable fluctuations of temperature.

The author adduced in evidence, the results of trials made by him in 1850-51, and by Messrs. Woods and Marshall in 1854, which showed that in the prevailing type of boilers, the evaporative power of good coal and good coke were as two to three: coal doing mechanically just two-thirds of the duty of coke. He proceeded to give an account of recent trials made by him in the beginning of this year with the "Canute," on the London and South Western Railway, one of Beattie's passenger-locomotives, planned expressly for the combustion of coal, and the heating of the feed-water. A pile of fire-bricks, through which the products of combustion must pass, was deposited in a combustion chamber, joining the fire box and the tubes, to act as an equalizer of temperature. The hind compartment of the fire-box also was arched over with fire-bricks. The heating apparatus was in two parts,—the condenser outside, which acted by throwing the feed-water in jets amongst the exhaust steam,—and the superheater inside the smoke-box, through which the feed-water was also passed just before entering the boiler. The cylinders were 15 inches diameter, with a length of stroke of 21 inches,—driving wheels 6½ feet,—fire grate area 16 square feet,—heating surface 769 square feet,—and the weight of bricks was 5¾ cwt. It was found that in the "Canute," the prevention of smoke was completely attained with ordinary care and attention; that the evaporative power of the coal was materially improved; and that the heating apparatus was decidedly beneficial. With the regular express trains the following results were obtained: average express trains 10½ carriages, estimated at 66 tons weight; average speed, excluding stoppages, 34 miles per hour; water evaporated on duty, 82 cubic feet per hour of the time the steam was on the piston; corresponding consumption of coal, 547 lbs. per hour, and 15 lbs. per train mile; water evaporated per pound of coal, 9·35 lbs.; average temperature of feed-water, 187° Fahr. Special train of 28 carriages weighing 203 tons: average speed, 30¾ miles per hour; water evaporated as before, 130 cubic feet per hour; coal per hour, 915 lbs., and per train mile 28¾ lbs.; water evaporated per pound of coal, 8·87 lbs., temperature of feed-water 212° Fahr. It was argued that, on Beattie's system, an economy of 36 per cent. of coal was effected in comparison with ordinary engines burning coal; and that this system was on a footing of equality with coke-burning engines, in evaporative efficiency of fuel, weight for weight.

The water supplied to locomotive boilers was stated to be generally impure, mechanically, or chemically, and to affect very injuriously the durability of the engine—reducing in one case the durability of the tubes from eight or nine years with soft water, to three years with hard water. The loss by priming with bad water was shown to be considerable. It was concluded that the water supplied to locomotives should be previously purified, chemically and mechanically, in large tanks or reservoirs.

With respect to the engine proper, the author maintained that the link motion was a sufficient and satisfactory expansion gear; that its merits were not appreciated; and that in the ordinary practice of expansive working in locomotives, the steam was not cut off earlier than at 40 to 50 per cent. of the stroke; but that, with proper arrangements, it might be cut off at one-fifth. He argued also that the steam should be superheated, and the cylinders perfectly protected; and that the slide valves should be balanced.

With respect to the carriage, a *resumé* of the early and current practice of engine boilers was given, from which it appeared that the system of six wheels, with central drivers, was the prevailing practice. It was argued that this system was best adapted to secure the main objects in the carriage,—a sufficiency of driving weight, and free and steady running at high speed; with the important proviso, that the revolving and reciprocating masses of the pistons and cranks and their connexions, should be balanced in the wheels. Evidence was adduced in proof of the economy of fuel effected by a correct equilibration of the engine.

In conclusion, an estimate was formed of the economy of working expenses due to the improvements described on the assumption,—first, that the consumption of fuel was an index to the working charges generally of the locomotive stock; second,—that the average cost per ton of coal and coke, for locomotive purposes, were as two to three generally; and third,—that the feed-water supplied to boilers was generally impure.

The following was an abstract of the successive items of economy of working charges, separately estimated :—

By the successful substitution of coal for coke,	33 per cent.
By efficiently heating the feed-water,	15 "
By the use of pure feed-water,	10 "
By protecting the cylinders, and superheating the steam,	10 "
By increased expansive working,	25 "
By the correct equilibration of the engine,	10 "

The gross resulting economy would then be represented, not, of course, by the direct sum of these per centages, but by the result of the successive reductions obtainable by their successive application. Thus, after making the first deduction of 33 per cent., there would remain a balance of 67 per cent. to be operated upon for the second deduction, which was 15 per cent.; but 15 per cent. of 67 was equivalent to 10 per cent of the original quantity, and would leave 67—10=57 per cent.: the third deduction to be made was 10 per cent. of 57, or 5·7 per cent. of the original, leaving 51·3 per cent., as the balance to be operated upon for the next deduction. Continuing the operation in this manner the gross resulting economy would amount to about 70 per cent. of the existing average working charges. Allowing for contingencies in the estimate, 50 per cent. was adopted by the author as the probable average saving that might be effected in the consumption of fuel, and generally in the working charges of the locomotive stock of the railways of the United Kingdom.

The average apportionment of the receipts on the Railways of this

country, was stated to be as follows, on the authority of Mr. Chattaway:—

Working charges, ...	46½ per cent.
Interest on guarantied capital, . .	28½ "
Dividends in respectof ordinary shares, . .	25 "
Gross receipts,	100

Also, that the average cost of locomotive power was 29·3 per cent of the receipts; consequently, the saving estimated by the author, would be one-half of this, or 15 per cent. of the receipts, and would raise the available dividends from 25 to 40 per cent. of the receipts; or from the average, on ordinary share capital, stated by Mr. Chattaway, as 3·14 per cent., to a dividend of 5 per cent. per annum.

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*On Wood Bearings for Screw Propeller Shafts.** By Mr. JOHN PENN, of London.

[Paper read before the Institution of Mechanical Engineers, January 30, 1856.]

In the bearings of the shafts of screw propellers a considerable difficulty has been experienced when the screw has not been kept in regular work, but has been required to stand still for several hours, or even days together, as is more particularly the case with war steamers. In such cases it has been found requisite, in timber vessels having copper sheathing, to protect the wrought iron screw-shaft by a brass casing, wherever exposed to the action of the sea water; since otherwise, the galvanic action excited by the copper, causes a serious and rapid corrosion of the iron shaft, and its bearings soon become injured. A similar action takes place also in iron vessels, but not to the same extent. The shaft is consequently cased throughout with a brass tube, A, as shown in the longitudinal section, Fig. 1, and the transverse section, Fig. 2; the tube A, fits close to the shaft B, at the journals, and is loose

WOOD BEARINGS.

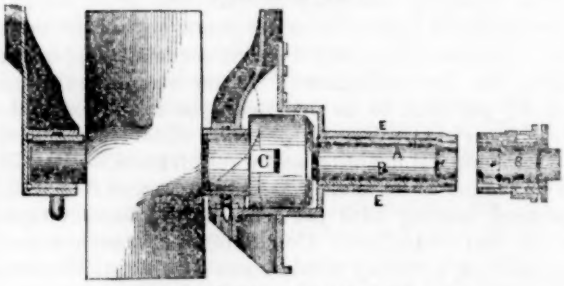


Fig. 1.—Longitudinal Section.

from it between them. But the friction and wear at the bearings is in this construction very great, as the brass casing of the journals has to turn in brass bushes; and the result is a very rapid wear, and a great

* From the Lond. Artizan, July, 1856.

difficulty in keeping the bearings long at work. Moreover, the screw propeller itself is a heavy mass, weighing in some cases from 10 to 12 tons, coupled at the end of the shaft by a T cross head C (Fig. 1), for the purpose of easily unshipping and raising it out of the water by means of the lifting bearers D D, when it is not required for steaming. The wear of the brass bush is very uncertain and various, and has been found to amount to as much as an inch in thickness in the course of a few months.

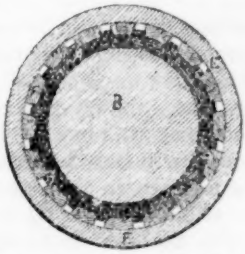
The author of this Paper, having had his attention forcibly called to the subject by these circumstances, made a series of experiments on different materials as bearing surfaces, and the final result has been the adoption of wood bearings for the screw-shafts, and these have now come into general use for this particular application with complete success.

The method in which the wood is employed is shown in Figs. 2 and 3; the ordinary brass bush E, has longitudinal dove-tailed grooves

Fig. 2.

Transverse Section.

Fig. 3.



Transverse Section of Shaft and Bearing.

formed on its face, which are filled with strips of hard wood F F; lignum vitæ has been generally used. The strips of wood are about $2\frac{1}{2}$ inches wide, with a space of about three-quarters of an inch between each, and stand out a quarter of an inch from the surface of the brass; water is kept constantly flowing between the strips along the shaft, and forms the only mode of lubrication, and this is found to prevent all tendency to heating or wearing of the journals.

Besides a large number of merchant vessels, upwards of 200 of the last new ships constructed for Her Majesty's service have been fitted with wood bearings, and all former vessels are being altered to the same plan as fast as opportunities will permit. As far as present experience has gone, neither the wood nor the journals appear to suffer any appreciable amount of wear or deterioration after many months continued exposure to the action of the water.

The *Himalaya*, of 3500 tons and 700 H. P., furnishes perhaps the best practical proof that can be adduced of the durability of the wood bearings. This ship was fitted in the first instance with the usual metallic bearings, but the wear was of so serious a nature as to induce the proprietors of the vessel to adopt the improved plan almost immediately after the author's discovery of its utility. The *Himalaya* being shortly afterwards purchased by the Government was employed as a transport, and during the first ten months of her service she steamed 20,000 miles without exhibiting the slightest signs of wear in those parts which had previously given so much trouble. The screw of the *Himalaya* weighs

upwards of 11 tons, and is not fitted with the means of raising it out of the water; and consequently, having no after bearing, the whole weight, in addition to the projecting portion of the shaft, is carried by the stern-bush alone.

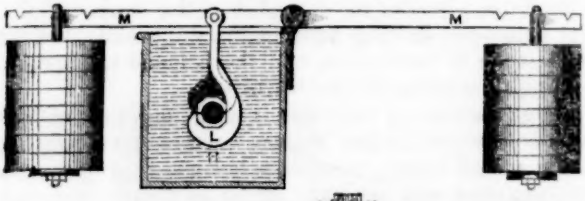
Her Majesty's sloop *Malacca*, of 200 H. P., also furnishes good evidence of the advantages of wood over brass and other metallic bearings. This vessel gave similar trouble to the *Himalaya* as long as it was fitted with brass bearings; but when last examined, since the application of the wood bearings, it had run over a still greater distance than any that it had accomplished previous to the use of them, without exhibiting the least signs of decay or want of adjustment in any of the bearings. The bearings had been fitted with lignum vitæ as a leading experiment for ships in the service of the Crown.

The ordinary brass bearings of screw-shafts are made very long in proportion to their diameter, so that the pressure on them is only about 60 lbs. per sq. inch when the journals are in contact throughout; but this pressure is considerably increased in practice, owing to the bearings being sometimes thrown out of line by the straining of the vessel.

In the wood bearings, the surface is reduced more than $\frac{1}{4}$th by the space left between the strips of wood; but it appears from the results of working, that $\frac{1}{10}$th of the area of bearing surface is sufficient with wood as compared with brass. The wood bearings are found to stand a working pressure as great as 2000 lbs. per sq. inch; and in some experiments made to ascertain the point at which abrasion would commence, a pressure of 8000 lbs. per sq. inch was sustained without producing abrasion; whereas brass on an iron bearing at a pressure of 200 lbs. per sq. inch was found to cut directly, whether lubricated with oil or water, and failed quickly by the rapid cutting or abrasion.

The experiments which led the author to the adoption of the wood

APPARATUS USED FOR EXPERIMENTS.—Fig. 4.—Transverse Section.



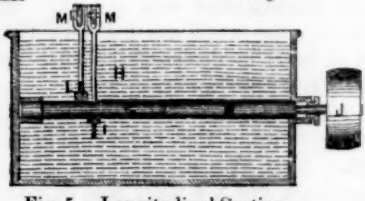


Fig. 5.—Longitudinal Section.

bearings were made with the apparatus shown in Figs. 4 and 5, consisting of a wrought iron axle, G, $1\frac{1}{2}$ in. diameter, running in wooden bearings at each end of a trough of water, H, 2 feet long. The axle was immersed wholly in the water, and driven by a pulley J, on the outer

end, at a speed of 700 revolutions per minute, representing a velocity of 260 feet per minute at the circumference of the axle, which corresponds with or rather exceeds the ordinary velocity of the journals of screw-shafts. One-half of the length of the axle K, was covered with brass, the object of which was to try alternately the effect on brass and iron under precisely the same circumstances. A cylindrical bearing $1\frac{1}{2}$ inches diameter and 2 inches long, was turned on the centre of each portion of the axle, upon which were placed the experimental bearings of which the relative frictions were to be ascertained; and in order to prevent any source of error from friction in the fixed bearings at the extremities of the axle, two experimental bearings, L L, were used at the same time, placed close together side by side, one above and the other below the axle, and pressed against the journal in opposite directions by two weighted levers, M M, having adjustable weights to regulate the pressure. By this arrangement, the axle was, as it were, suspended freely in the trough of water, having no material friction in the fixed bearings at the extremities.

The relative friction of the different materials under trial was measured by the rise of the temperature of the water in the trough in a given time, caused by the rotation of the axle, the quantity of water being exactly 2 cubic feet in each case, and at the same initial temperature. In estimating the pressure to which the bearings were subjected, 1 sq. inch of bearing surface was used, and the total weight on each bearing gave the pressure in lbs. per sq. inch.

The particulars of the experiments are given in the Table appended, and the general results obtained were as follows:—

Description of Bearing.	Pressure per sq. in.	Time of Running.	Result of Experiment.
	lbs.		
Brass on Iron,	448	30 minutes.	Little or no cutting.
" "	675	1 hour.	Cut and abraded.
" "	4480	—	Seized and stuck fast immediately.
Lignum Vitæ on Iron,	1250	36 hours.	No signs of wear; original slight scratch not worn out.
Box on Brass,	4480	5 minutes.	Not cut.
Lignum Vitæ on Brass,	4000	5 minutes.	No injury. This specimen is shown full size in Fig. 6.
Snake-wood on Brass,	4000	5 minutes.	No injury. Shown full size in Fig. 6.
Cam-wood on Brass,	8000	5 minutes.	" " " Fig. 7.

In the foregoing experiments, the principal object was the prevention

PIECES OF WOOD EXPERIMENTED UPON.

Fig. 6.—Full Size.

Fig. 7.—Full Size.

of the serious evils attending the ordinary bearings of screw-shafts; and

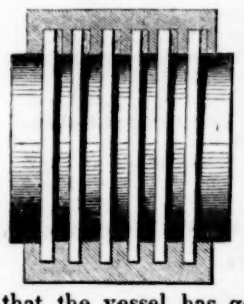
the circumstances under which the experiments were conducted were therefore arranged to correspond as nearly as possible with those experienced in the actual working of ordinary screw-shafts; the experimental axle was wholly immersed in salt water, and was driven in all cases at a speed equivalent to that of screw-shafts on the largest scale.

The result obtained from these experiments was so definite and satisfactory that arrangements were immediately made for the application of the wood bearings to the screw-shafts of Her Majesty's ships, and these have in every instance succeeded beyond expectation. The author proposes, however, to resume the experiments on the first opportunity, in reference to the application of the wood bearings to other purposes in machinery, and he will be happy to communicate the results to the Institution on a future occasion.

The general results at present appear to point to the use of a plentiful supply of water, to carry off the heat caused by the friction of the bearings; and in the cases where this can be accomplished thoroughly, so as to carry off the heat as fast as it is generated, a brass journal revolving in hard wood bearings is practically perfect, showing no perceptible wear under a much more severe pressure than is usually met with in machinery. The two rubbing surfaces appear in reality to run without any lubricating material between them, and the water acts merely as a conductor to carry off the heat as rapidly as it is produced.

One other application of the wood bearings may be mentioned, which has been practically tried, and found very advantageous. The bearing which receives the thrust or propelling effect of the screw in the direction of the vessel's motion is formed of a series of collars on the shaft, running in corresponding grooves in the brasses, which have been found to wear very seriously, in a similar manner to the main bearings of the screw-shafts. The thrust-bearing of the *Himalaya*, which is shown in Fig. 8, had the brasses worn away longitudinally nearly three-quarters of an inch at each collar, and this was repaired by the engineer whilst on the voyage, by putting in a set of rings of lignum vitæ as an experiment, filling up the worn space, as shown in the upper half of Fig. 8. The wood was merely sawn into half rings, the lower pieces being slipped in from above, without lifting the shaft from its bearing. This plan answered completely, and no perceptible wear was found in the wood rings after the voyage home, the original saw marks not even being effaced; and the bearing proved so satisfactory, although only temporarily constructed, that the vessel has gone to sea again without any alteration. In this case the wood bearing was allowed to work most of the time with oil alone as a lubricating material.

Fig. 8.



Of the various kinds of wood that have been tried in the experiments, lignum vitæ appears to be very satisfactory, and nearly as good as any, and it has the practical advantage of being less expensive, and readily obtainable.

TABLE *of Experiments on Friction of Bearings.*

Description of Bearing.	Area of Bearing.	Total Pressure.	Pressure per sq. in.	Time of Running.	Result of Experiment.
	sq.in	lbs.	lbs.	min.	
Brass on Brass,	$\frac{1}{8}$	448	3584	15	
Box on "	1	560	560	10	Marks not out.
" "	$\frac{1}{8}$	448	3584	5	Not cut.
" "	$\frac{1}{8}$	560	4480	5	"
" "	$\frac{1}{8}$	560	4480	5	"
" "	$\frac{1}{8}$	672	5376		Cut and abraded; side grain.
" "	$\frac{1}{8}$	672	5376	5	End grain; not cut.
Lignum Vitæ on Brass,	1	672	672	15	Scratches made with tip of knife; not touched.
" " "	$\frac{1}{8}$	560	4480	5	Cut a little.
Brass on Brass (salt water)	1	448	448	30	Little or no cutting.
" " " "	$\frac{1}{8}$	448	3584	6	
" Iron,	1	448	448	5	Cut.
New Brass on Iron,	1	560	560	10	"
Brass on Iron,	1	675	675	60	" and abraded.
" "	$\frac{1}{8}$	560	4480		Would not revolve; seized and stuck fast immediately.
Babbitt's Metal on Iron,	$\frac{1}{4}$	400	1600	8	Rolled out sideways.
Kingston's " "	$\frac{1}{4}$	400	1600	6	" "
Box on Iron,	1	448	448	30	No perceptible wear.
" "	$\frac{1}{8}$	448	3584	19	
" "	$\frac{1}{8}$	448	3584	5	But little worn.
Lignum Vitæ on Brass,	1	560	560	10	Mark not out.
" "	1	1250	1250	2160	No signs of wear; original slight scratch not out.
" "	$\frac{1}{4}$	1000	4000	5	No injury.
Snake-wood on Brass,	$\frac{1}{4}$	1000	4000	5	" "
Cam-wood "	$\frac{1}{4}$	1000	8000	5	" "

Mr. F. P. SMITH stated that, in the unavoidable absence of Mr. Penn from illness, he had attended the meeting in his stead, and would be able to give any further explanation that might be desired upon the subject, as the experiments upon the wood bearings had been conducted under his own superintendence. He exhibited a number of specimens of bearings that had been experimented upon, consisting of different kinds of wood, and also of ivory, brass, and white metal, and said that the experiments would have been conducted further, as had been suggested, had time allowed; but the bearings of the screw-shafts in the war steamers that were under consideration were wearing away so fast, that Mr. Penn was glad to be able to arrive at a practicul conclusion at once, as to the mode of stopping the evil that had been the special object of the inquiry, particularly as the results of the experiments, so far as they had been carried out, had proved so much more satisfactory and definite than could have been anticipated. The pieces of wood that had been used for trial were apparently insignificant, and their small size might cause the experiments to be looked upon as not sufficiently practical; but it had been found in the first trials that a pressure of

1000 lbs. per square inch on a piece of wood of one square inch area would not wear out the scratch of a pin, after running twenty-four or thirty-six hours; and the only available method at the time of increasing the pressure per square inch had been to reduce the size of the pieces of wood, retaining the same weights in the apparatus with which the experiments were made. The slips of wood of 1 inch in length had accordingly been reduced in width to $\frac{1}{4}$th inch, in the expectation that a few minutes would suffice to give a definite result, but no wear could even then be produced; the area was then reduced to $\frac{1}{8}$th square inch, and still no abrasion took place under a pressure of 1000 lbs., or 8000lbs. per square inch; the experiment was limited to this pressure by the slipping of the strap upon the pulley by which the shaft was driven. The little bit of wood used in this experiment had been left running for three hours at a speed of 260 feet per minute, and had been tried in both fresh water and salt water, the latter salter than the sea, with no difference in the result. A brass bearing that had been driven at the same speed had been cut immediately at a pressure of 220 to 231 lbs. per square inch, so remarkable was the difference between wood and brass; and Babbitt's soft metal, Kingston's metal, and other mixtures, had also been tried, but were not capable of working under a pressure at all approaching that admissible with the wood bearings. Several soft woods had been tried, all of which stood well; and among them poplar, which was a very soft wood, stood a heavy pressure with very little wear. It was the intention of Mr. Penn, at the earliest opportunity, to try a second series of experiments, in a more complete manner, carrying them out, if possible, to the limits in each case of the material tested. The test to which the wood bearings had been subjected in the *Himalaya* was the severest to which it was possible that they could be exposed in practice. In this vessel, the screw was made without any provision for drawing it up, and had accordingly no after-bearing in the rudder-post; the weight of the screw was $11\frac{1}{4}$ tons, or 13 tons with the overhanging portion of the shaft, and the bearing being 18 inches in diameter, and 4 feet in length; the pressure was about 60 lbs. per sq. inch. The wood was applied in twenty strips, each 4 feet long and 3 inches wide, fitted close together round the inner circumference of the bush, the edges being beveled so as to leave a groove nearly 1 inch wide between each of the strips of wood, for the water to flow through. After running 20,000 miles with the wood bearings the vessel had occasion to change her screw, thus affording a good opportunity for examining the condition of the bearings, and it was found that the total clearance of the shaft in the bearing did not amount to $\frac{1}{8}$th inch at the top, including the clearance which there must have been when originally fitted. The *Malacca* also had run 30,000 miles without any signs of wear in the wood bearings.

Mr. James Brown inquired whether the wood bearings had been applied to any rubbing surfaces, such as cross-bar guides, in which the wear was caused by a reciprocating motion; and also whether any trial had been made of them for main shaft bearings.

Mr. Smith replied that they had not yet been tried for a reciprocating motion, but had been applied to the bearings of a crank shaft driving

the machinery in Mr. Penn's factory. In this application, however, the wood had not proved superior to brass, and was attended with some inconvenience, as special provision was required to ensure a liberal supply of water to the bearings, otherwise the wood was speedily charred, and became useless. It had also been tried for the crank pin of the *Malacca*, but was not found better than other bearings, such as soft metal; in such situations there were no means of maintaining the wood in a water bath to keep down the temperature, which appeared to be essential in the use of wood for bearings.

The CHAIRMAN observed that the hard wood specimens that were exhibited had got a fine polish upon their rubbing faces, and probably required to be kept always under water for that purpose. They appeared to have been dove-tailed into the brass bush in every case, and this precaution would be necessary in order to prevent them from spreading laterally under great pressures.

Mr. SMITH said that in the wood bearings considerable heat was generated with the very heavy pressures in the experiments, and the wood became so hot, although immersed in water, that it could not be touched with the hand, showing how rapidly the bearing would have heated, if the heat had not been continually carried off by the surrounding water. Oil had been tried instead of water, and gave no difference in the result, if used in a large quantity like the water, but it did not answer if applied only in the same quantity as to ordinary brass bearings, as there was then not enough to carry off the heat as fast it was generated.

The CHAIRMAN observed that the complete immersion of the whole bearing in water appeared to be an essential element in the successful application of wood, and he suggested that in future experiments a thermometer should be applied direct to the wood or metal bearing under trial, in order to ascertain the exact temperature, as it was evident that this would be somewhat higher than that of the surrounding water. The same experiments might be made very serviceable to determine the relative friction of the various kinds of wood and metal tested. He inquired whether wood had been tried in different positions of the fibre, endways as well as lengthways of the grain.

Mr. SMITH replied that it had been tried in all three positions, endways, in the direction of the fibre, and transversely to the fibre; but the experiments had not been continued long enough to test their relative value. He was inclined to think the endway of the grain was the best mode of applying wood, and this had been done by drilling a set of shallow holes in the bush, into which wood-plugs were fixed; but this plan was objectionable in practice, as the wood-plugs were liable to fall out when dry, and the readiest mode of application was flatways, that is, so that the friction would be transversely to the fibre; the latter method had been hitherto exclusively adopted in the wood bearings of screw-shafts, and the wood could be readily and quickly applied to existing bearings, by planing out dove-toiled grooves in the brass bush. In the experiments, the heating of the brass and wood had been measured by the rise of temperature of the water in the trough, and the results had been very marked; with the brass bearing, under a pressure of 200 lbs. per square inch, the temperature of the two cubic feet of water

rose to 120° or 130° in one hour, whilst with the wood bearing, under a pressure of 4000 lbs. per square inch, the temperature never exceeded 90° after any length of time, the heat beyond that limit being dissipated as fast as generated.

Mr. HAWKES remarked that he had had an opportunity of seeing the *Himalaya*, immediately on her return from her first voyage, and on inquiring how the stern stuffing-box of the screw-shaft was kept constantly tight, was told that it was not found necessary it should be kept tight, and it was even preferable to have it loose, allowing the water to flow through freely; the vessel had indeed made part of the voyage with the stuffing-box gland entirely removed, the water running through in a large stream, and being pumped out by the bilge-pump, and the result had been successful in keeping down the temperature of the bearings. He inquired how much water was allowed to run through with the wood bearings, and whether any extra pump was generally required to remove it.

Mr. SMITH said that the gland was frequently let loose to allow the water to flow through, about as much water running in as would fill an inch pipe; this water was ordinarily left to run into the bilge, and pumped out by the bilge-pump, without the provision of a special pump. He might mention that in one instance, where the brass bearing was cutting severely, he had observed that the water running from the stuffing-box was impregnated with fine brass scales, to such an extent that seven ounces were caught in a couple of hours.

The CHAIRMAN remarked that the paper contained much interesting and important information, and he hoped Mr. Penn would continue the experiments under different circumstances of speed and pressure, and with dry wood as well as under water, and would communicate the further results to the Institution at a future meeting. He proposed a vote of thanks to Mr. Penn, and also to Mr. Smith, which were passed.

AMERICAN PATENTS.

List of American Patents which issued from July 1st, to July 22d, 1856, (inclusive,) with Exemplifications.

JULY 1.

1. For an *Improved Mode of Securing Tires on Wheels;* William A. Ashe, City of New York.

Claim.—"Making the tire with a narrow tongue at the centre of its width on its inner circumference, and the outer periphery of the circle of felloes, with a groove to receive said tongue, for the purpose of confining the tire on the wheel, and in order that the metal on the tire on either side of said tongue may be made quite thin, and of unvarying thickness from the tongue to the said edges of the tire."

2. For an *Improvement in Dental Forceps;* Hazen J. Bachelder, West Fairlee, Vt.

Claim.—"Applying or connecting the forceps and the bearer, by a stirrup and slot, irrespective of the universal joint, or the equivalent thereof, so that the distance between the extreme end of the bearer and the points or ends of the jaws or forceps may be adjusted, or, in other words, either increased or diminished as circumstances may require."

3. For an *Improved Machine for Sawing Felloes;* David Bowen, Wadesville, Va.

Claim.—"The plank clamps, simultaneously adjustable in opposite directions, in combination with the mechanism connecting the case with the saw-gate."

4. For an *Improved Brake for Wagons;* D. F. Breed, Fulton, New York.

Claim.—"The combination and arrangement of the revolving blocks, rubbers, connecting rods, crank lever and yoke."

5. For an *Improvement in Melodeons;* Jeremiah Carhart, City of New York.

Claim.—"1st, The coupler, arranged in a cavity of the key. 2d, The double springs, constructed to act each on a valve of each set, so that by turning it the two valves may be liberated and capable of removal."

6. For an *Improved Machine for Reaming and Tapping Gas Fittings;* Henry A. Chapin, Springfield, Massachusetts.

Claim.—"The rotating tool holder, in combination with the revolving check or clamp for holding the fitting."

7. For an *Improved Method of Framing and Straining Wood Saws;* E. S. Clapp, Montague, Massachusetts.

Claim.—"Constructing the saw frame with the two bows connected by a hinge, and having the rack attached to the bow, the rack passing through a slot in the bow—the saw being connected to the bows, and the straining rod connected to the bows."

8. For an *Improvement in Rotating Pumps;* Charles N. Clow, Port Byron, N. Y.

Claim.—"Cams or pistons, having smooth peripheries made to revolve with the peripheries in contact, to form the abutment by gear wheels, on the same shafts as said cams, the pitch line of which gears correspond in shape with the peripheries of the cams."

9. For an *Improved Metallic Pen;* Alphonso Craytey, Brooklyn, New York.

Claim.—"The pen point protector and ink distributor, in combination with metallic pens."

10. For an *Improvement in Concentrating Apparatus for Sulphuric Acid;* William T. Clough, Newark, New Jersey.

Claim.—"The construction of a furnace so that the sulphuric acid will not affect or injure the lead or mineral tank or pan during the process of concentration, by means of a hot surface being placed above the liquor."

11. For an *Improvement in Machines for Cutting and Coring Apples;* Cook Darling, Utica, New York.

Claim.—"The machine for dividing and coring apples at one operation—the knives having a lateral as well as a vertical motion in their descent, so as to separate the core by a cut, wider in the centre than at the ends."

12. For an *Improvement in the Base-piece of Locomotive Smoke Stacks;* Peter S. Ebbert, Chicago, Illinois.

Claim.—"The construction of saddles or base pieces, for the stacks or chimneys of locomotives, in which the feed water for the boilers is heated in the trough or receiver for catching the water or condensed steam that drips—and the waste pipe for conveying it away."

13. For an *Improved Metallic Hook for Labels;* Samuel B. Fay, City of New York.

Claim.—"The construction of tags or labels, by affixing thereto a hook, so formed as to readily hook into the goods to be marked—and by the spring of its shank retain its position, without being liable to become readily detached."

14. For an *Improved Method of Operating Valves of Steam Pumps;* Robt. H. Fletcher, Brooklyn, New York.

Claim.—"Enclosing the piston head within an inner cylinder, which fits within the outside cylinder of the pump—said inner cylinder being somewhat shorter than the space between the outside cylinder heads, and so constructed as to alternately open and close the ports through which the water passes in and out of said pump, and operated by the piston."

15. For an *Improved Method of Making Boxes of Paper Pulp;* Erasmus French and Charles Frost, Waterbury, Conn.

Claim.—"1st, The method of disengaging the article when formed from the mould, by forcing air upon it, by bringing down the piston, or other equivalent means. 2d, The use of the movable block and the movable shelf with a cavity in it—both block and cavity corresponding in shape to the boxes or article made, and are used to receive them and preserve their shape when they are blown from the mould. 3d, The circular groove in the rim, and such a construction of the plate to which the mould is attached as would be equivalent to it—the object of this groove being to receive the water which enters the cylinder through the perforated mould, when the pulp is deposited thereon, so that it may be drawn off by the stop-cock—whereas, this water, if permitted to remain and accumulate, would, by the pressure of the air upon it, be forced through the sides of the article formed, when they are blown from the mould."

16. For an *Improvement in Steam Pressure Regulators;* William S. Gale, City of New York.

Claim.—"The arrangement of the groove in the piston, in connexion with the gasket."

17. For an *Improved Machine for Sawing Stone;* John Grason, Queenstown, Md.

Claim.—"Operating double sets of saws, arranged at right angles with each other, by means of the power-moving rack beam, combined with the rack beam, by means of the toothed wheel, which works upon the adjustable sliding beam."

18. For an *Improvement in Refrigerating Pitchers;* Franklin D. Hall, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the tube or conduit pipe, and the spout with which it is connected."

19. For an *Improved Paper Clip;* John L. Harvey and C. A. Mills, Dubuque, Iowa.

Claim.—"The attachment of the clip and spring to the outer cylinder, by which the clip can be raised or lowered, so as to accommodate to a larger or smaller quantity of paper, the effect of the spring upon the clip being the same in any position."

20. For an *Improved Method of Turning Carriage, &c., Axletrees;* John Hennon, Brighton, Pennsylvania.

Claim.—"The turning of spindles on axles for carriages or all other similar articles, and the rule or principle of ascertaining the lines on the timber, and of finding the centre in accordance therewith—and of so adjusting a movable centre or slide point in any common lathe, as to give an axle any desired degree of inclination for the bottom or pitch line, and at the same time obtaining more or less gether at will."

21. For an *Improved Mode of Adjusting Carriage Springs;* M. G. Hubbard, Penn Yan, New York.

Claim.—"The double fulcrum iron with a changeable angle."

22. For an *Improvement in Bedsteads;* Silas Huddleston, Cottage Grove, Indiana.

Claim.—"The arrangement, consisting of the device, end rail, and stop pin, for the purpose of tightening and retaining the cord which forms the bottom of the bedstead."

23. For an *Improvement in Harvesters;* Johs C. Huermann and Jonathan Reeves, Camden, New Jersey.

Claim.—"The wheel with its projection, in combination with the levers and their scrapers, the rods, levers, arms, for the double purpose of clearing the projections from dirt, and agitating the cutters."

24. For an *Improvement in Raking Attachment for Reapers;* John C. Hicks, Rockaway, New York.

Claim.—"Operating the rakes by means of the segments and rack with pin attached, in combination with the slotted arm or crank, and groove in the platform."

25. For an *Improved Match Machine;* Lawrence Holmes, Paterson, New Jersey.

Claim.—"1st, The combination of the reeding rollers and separating collars. 2d, In combination with the above die-plate and knives for completing the splint. 3d, The shield."

26. For an *Improvement in Disinfecting Pastiles;* Andrew Lanergan, Boston, Mass.

Claim.—"A disinfecting pastile or composition, made so as to be capable of being ignited and burned, and while burning to evolve chlorine and hydrochloric acid gas, either in a free state, or so combined or mixed with one or more other gases, as to be capable of acting as a disinfecting agent."

27. For an *Improved Gun Carriage;* John Laurens, Charleston, S. C.

Claim.—"The entire gun carriage, it being totally different from any gun carriage that is now, or ever has been in use, with the sole exception of its carrying a gun."

28. For an *Improvement in Netting Machines;* John McMullen, Baltimore, Md.

Claim.—"Finishing the meshes of the net and tightening the knot, by the simultaneous longitudinal and lateral strain of pressure-rollers and cloth beam—the relative position of said rollers and beam being automatically preserved."

29. For an *Improvement in Steam Gauges;* W. K. Miller, Canton, Ohio.

Claim.—"The arrangement of the syphon tube, within the cement holding tube or case, and both within the metal case, with transparent front, and thereby forming cement and transparent liquid chamber within the case."

30. For an *Improved Brass Kettle Machine;* O. W. Minard, Waterbury, Conn.

Claim.—"The method of polishing or burnishing either of the surfaces of the metal, during, and by the rolling action, by causing one of the rolling surfaces to move faster or slower than the other, to produce a slip. Also, in combination with the forming and working rollers giving to the carriage which carries the clamps with the disk of metal, a diagonal movement, to keep the inner surface of the metal in contact with the forming roller, during the rolling action."

31. For an *Improved Machine for Mincing Meat;* Oren Moses, Malone, New York.

Claim.—"The combination of the cutting box with the cutting cylinder, and with the other parts of the machine, in such a manner, that the position of said box can be readily lowered, partially revolved, and then elevated again for the purpose, causing the reciprocating movements of said box to so act upon the disks of the cutting cylinder, as to make them cut in transverse directions within said cutting box. Also, the combination of the comb and its shaft, with the shaft of the cutting cylinder, in such a manner, as to cause the teeth of said comb to act between the cutting disk on the rising side of the cutting cylinder."

32. For an *Improved Bedstead;* Ansel Moon, Bristol, Wisconsin.

Claim.—"The application of the 'lock joint,' (so-called,) to the manufacture of bedsteads."

33. For an *Improvement in Swinging Spout for Feeding Mill Stones;* Milton and Charles Painter, Orange Mills, Maryland.

Claim—"Suspending the oblique eye feeding tube, by universal joint from above, in combination with, and for free rotation and universal movement of said tube by the revolving stone."

34. For an *Improvement in Independent Seconds Movement for Watches;* George P. Reed, Waltham, Mass.

Claim.—"The combination of the gear wheel, the ratchet, curved lever, draw pawl, the spring, the detacher, the whole constituting a mechanism, applicable to the arbor of the index hand of a dial, and for imparting to the same an intermittent rotary movement."

35. For an *Improvement in Reaping and Mowing Machines;* John Reily, Hart Prairie, Wisconsin.

Claim.—"1st, The method of raising and lowering the cutter bar, either from the driver's or raker's seat, or from both simultaneously, by means of the rod and lever, in combination with the lever. 2d, Hinging the driver's seat to the drag tongue, when combined with a brace, pivoted to the axis of motion of the machine."

36. For an *Improved Machine for Sweeping Streets;* D. H. Richards, Georgetown, Massachusetts.

Claim.—"1st, The brush, operated by means of the cam groove. 2d, The plate operating for the purpose of raising the brush upon the return stroke when sweeping at the sides of the streets."

37. For an *Improvement in Machines for Making and Kneading Bread;* Socrates M. Ridgaway, St. Michaels, Maryland.

Claim.—"The combination of the fluted roller, with a knead trough."

38. For an *Improvement in Corn and Cob Mills;* Cyrus Roberts, Belleville, Illinois.

Claim.—"The method of rendering the grinding surface of the hull or concave concentric with that of the ball—and of preserving this concentricity, by mounting the revolving spider, between the arms of which, the rim of the hull is secured and adjusted, upon a neck or journal formed on the underside of the ball."

39. For an *Improved Balance-Gate for Flumes in Water Power;* Daniel Robison' Senoxville, Pennsylvania.

Claim.—"The two sliding gates placed at opposite sides of the penstock, and connected by bars."

40. For an *Improvement in Blasting Powder;* William Silver, Jr., Wapwollopen, Pennsylvania.

Claim.—"The explosive compound herein described, consisting of rags or paper saturated and coated with a mixture of gunpowder, chlorate of potassa, and powdered calcined cork."

41. For an *Improvement in Locks;* Henry Isham, New Britain, Conn.

Claim.—"Moving a series of rotating cogged tumblers at right angles to the line of motion of the bolt by means of a slot in the bolt, or any equivalent thereof, operating on the shaft or spindle of the tumblers, whereby the cogs on the said tumblers can be made to engage the cogged racks on the key slides previously set by the key before the stop pin on the bolt leaves the slots in the tumbler, and will so remain engaged while the bolt continues its movement to carry the said stop pin to some distance beyond the periphery of the tumblers, so that in any attempt to pick the lock, the said stop pin shall not rest against the peripheries of the tumblers to admit of feeling, as it is called, to bring the tumblers in succession to the required position to allow the lock to be picked. Also, in combination with the method of operating the tumblers by the throw of the bolt, and giving to the bolt the capacity to move after the tumblers have been engaged with the key slides to carry the slot pin some distance beyond the periphery of the tumblers, the employment of a stop or hold-fast, operated by the bolt to lock or hold-fast the key slides or tumblers before the stop pin on the bolt reaches the periphery of the tumblers, whereby the said slides and tumblers, if not previously arranged by the proper key, will become locked in their disarranged condition, before the stop pin on the bolt can reach the peripheries of the tumblers, to feel when the tumblers are brought to the required position by a pick. Also, forming the bitt of the key of a series of sector pinions, which may be shifted to change the combination or permutation, in combination with a series of cogged rack slides for operating the tumblers. Also, the notched collar on the key stem, in combination with the lipped spring at the entrance of the key hole, whereby the key cannot be taken out of the key hole without turning it entirely around, to give to the key slides their entire range of motion every time the lock is opened and shut, and thus avoid the possibility of determining the required position of the key slides by the wear of the moving parts, which would be the case if only moved each time to the distance required for unlocking, particularly, if the same combination should continue to be used for a considerable length of time."

42. For an *Improvement in Breech Loading Fire Arms;* Benjamin F. Joslyn, Worcester, Massachusetts.

Claim.—"A sliding valve in a chamber. Also, combining the spring with the valve."

43. For an *Improved Machine for Grinding Butt Hinges;* Cyrus Kenney and Wm. Gurley, Troy, New York.

Claim.—"The improvement for hanging the pinch block or cam, on or to the elastic support, arranged in combination with the bed and stop. Also, mounting the griper upon the rock shaft, arranged in combination with the grindstone."

44. For an *Improved Marble Sawing Machine;* Henry Lawrence, City of N. York.

Claim.—"Mounting the two saw frames each in ways on the side of the frame, in combination with, and when such frame is provided at its ends with slides fitted to slide up and down in separate ways, connected with the main frame by journals or stems

adapted to turn and slide in suitable slots, and there held and secured, whereby the said saws can be set each independently of the other, to have its cutting and feeding motions at any desired angle by simply turning or shifting the journals of the said ways. Also, in combination with the before described manner of mounting the two saw frames in adjustable sliding frames adapted to shifting and turning ways, the mode of imparting motion to said saw gates, by means of pitmen or connecting rods hinged at one end to the saw gate, and at the other fitted to slide and turn in rockers mounted in and free to turn in a rocking frame, which receives motion from some suitable motor."

45. For an *Improvement in Curtain Fixtures;* James Stephens, City of New York.

Claim.—"Attaching the coil spring to a swinging pendant, and connecting the same to an arbor, to which the shade roller is attached by the pinion and the toothed wheel, the arbor having a ratchet upon it, in which ratchet a pawl attached to the pendant catches."

46. For an *Improvement in Steam Pressure Indicators and Regulators;* William Mt. Storm, City of New York.

Claim.—"The combination of a simple steam-tight metal tube, with a fixed and open (not steam-tight) frame or support, in which both of its extremities are held stationary, while the motion of its middle left free, is communicated to its work, in such manner, or by a device combined with the instrument, as to multiply its range of action; the communication of the tube with the steam of the boiler being separate and distinct, moreover, from that to the water space of the boiler, and filled with a cold fluid, and so arranged as not to allow any circulation through it of the heated water from the boiler. Also, in combination with the tube, the 'key nut,' or its equivalent."

47. For an *Improvement in Cotton and Seed Planters;* J. A. Stewart, Franklyn, Ky.

Claim.—"The hopper or wheel formed of the disks, and zig-zag rim, provided with slats. Also, the hopper or wheel, in combination with the clearing rod or spike."

48. For an *Improvement in Machinery for Felting Hat Bodies;* Joseph Thomas, Brooklyn, New York."

Claim.—"Giving the vibrating motion to the reservoir wheel, by the combined action of the screw and cam, or any equivalent device."

49. For an *Improved Filter Attachment for Faucets;* James H. Wright, City of New York.

Claim.—"Placing the filtering material or medium, within the chamber of the faucet and above the pipe, and having a pipe and cock at the upper end of the chamber, and a pipe and cock at its lower end. Also, placing the filtering material or medium upon the bars."

50. For an *Improved Guard Finger for Harvesters;* Walter A. Wood, Hoosick Falls, New York.

Claim.—"The particular form and construction of the finger or guard, viz: with the forked cap, recess or depression, raised edges and neck behind them, by means of which, the cutting is facilitated."

51. For a *Macaroni Server;* Abner L. Lincoln, Assignor to self and Charles M. Foss, Boston, Massachusetts.

Claim.—"The described 'macaroni server,' as made with its teeth or prongs arranged with respect to its blade."

52. For an *Improvement in Dry Lime Gas Purifiers;* Charles F. Werner, City of N. York, and Charles Deutschmann, Buffalo, New York.

Claim.—"The arrangement of the lime purifier in the same vessel or cooler with the cooling pipe, when the said cooling pipe is arranged in form below the purifier."

53. For an *Improvement in Machines for Hulling and Scouring Grain, Seed, &c.;* Oliver P. Stevens, Cleveland, Ohio.

Claim.—"1st, The perforated fans, in combination with teeth set in the fan case. 2d, The arrangement of the upper section of the fan case, in its relation to the chimney, in combination with the fans and guides. 3d, The adjustable guides or deflectors. 4th, The air passages or chambers arranged in each end and on the top of the fan case, in connexion with the vertical trunk. 5th, The valve, operated in the manner described, and in combination with the chimney."

54. For an *Improved Magazine Hammer for Fire Arms;* James N. Ward, United States Army.

Claim.—"The feed wheel, ratchet and pawl, in combination with each other, and the coil chamber in the hammer head; said wheels being so situated relative to the pawl, that the outer face of the feed wheel shall be within the inner plane of the pawl cavity. 2d, The combination of the core with the hammer, for severing the protruding portion of the primer, and closing the primer passage."

55. For an *Improvement in Machines for Mowing Grass and Cutting Grain;* Anson S. Hathaway, Assignor to self and Frederick Ruggles, Columbia, Maine.

Claim.—"The scythes, when arranged in relation to each other, and operated in mechanism constructed and arranged as described, in combination with the peculiarly constructed and independent acting guards."

56. For an *Improvement in Machinery for Combing Wool;* Wm. H. Walton, Assignor to self and J. E. Winants, Brooklyn, New York.

Claim.—"1st, The reversing comb, arranged as described, for conveying the wool from the feed rollers past the cylinders and on the endless chain comb. 2d, In combination with the above named reversing comb, the brush in rear thereof. 3d, The clearing bar for clearing the fibres of wool from the cylinder before the comb reverses, when combined with the reversing comb."

JULY 8.

57. For an *Improved Padlock;* Solomon Andrews, Perth Amboy, New Jersey.

Claim.—"Making a spring to answer the double purpose of a spring and ratchet tumbler, which I denominate a spring-tumbler. Also, the opening spring, being a spring brought into action by the key, for the purpose of drawing back the hooks, or unlocking the locks. Also, the combination of the spring-tumblers with the hooks, holding back the hooks when unlocked, so as to constitute a perfectly racked tumbler lock a self-locking one."

58. For an *Improved Method of Extinguishing Fires;* Robert B. Armitage, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the main pipe with the branch pipe, the arms and jets, which, in connexion with the cords and levers combined, operate as a self-acting fire extinguisher."

59. For an *Improved Machine for Upsetting Tire;* Henry Barringer, Berry, Ill.

Claim.—"The combination of the slotted bar, the clamping lever and sliding plate, with the clamping lever, for the purpose of clamping and unclamping the tire, with one motion of the lever."

60. For an *Improved Method of Drawing Water from Wells;* H. B. Barber, Scott, New York.

Claim.—"The use of the lever, in combination with the two pawls and toothed pulleys, or their equivalents, for the purpose of automatically arresting the pulleys, when the buckets are at a given height, and keeping them suspended during their discharge. Also, combining the two pulleys, mounted on one shaft, and driven by the same pinion, with the hasp and thumb-screw, for the purpose of connecting or disconnecting said pulleys, and thus working one or two buckets."

61. For an *Improvement in Rotary Pumps;* James A. Bazin, Canton, Mass.

Claim.—"The means employed for moving the two pistons alternately,—the same consisting of the toggle arms attached to the cranks of the pistons, and operating in the circular grooves, in such a manner, as to hold one crank and its piston stationary, while the other crank and its piston are moving."

62. For an *Improvement in Roofing Cement;* Horace Billings, Beardstown, Ill.

Claim.—"My improved roof coating cement, or composition of matter, produced by combining shellac (or seed lac), rosin, linseed oil (or its equivalent), and powdered stealite (or its equivalent), in proportions which will give the said composition the character, and adapt it to the purposes set forth."

63. For an *Improvement in Brick Machines;* E. Brannon and R. Peterson, Green Castle, Indiana.

Claim.—"1st, The mould box, provided with the plungers—when said plungers are operated by the springs and rods, working in the grooves, for the purpose of allowing the mould box to receive the clay, and also to eject the compressed clay therefrom. 2d, We claim operating the mould box, or giving it a reciprocating motion, with the necessary 'dwells' to allow the box to be filled with clay; and also, to allow the clay to be pressed therein, by means of the rack-bar and wheels. 3d, We claim the combination of the plunger rods, working in grooves, with the mould box provided with the plungers."

64. For an *Improved Vise;* Hiram C. Brown, Yellow Springs, Ohio.

Claim.—"The rod, arranged and operating so that by pushing it back endwise, both ends will be simultaneously raised, and thereby lift the pawl from any part of the ratch. Also, adjusting and retaining the jaws parallel with each other, or to any desired angle, either by varying the length of the brace rod, between its points of contact at the top, and on the movable jaw, or by varying the position of the lower point of contact. Also, the use of the adjustable sliding rod, arranged and connected with the brace rod."

65. For an *Improvement in Dies for Stamping or Pressing Sheet Metal;* William M. Booth and James H. Mills, Buffalo, New York.

Claim.—"Pressing, stamping, or forming metal, viz: the upper and lower dies, or their equivalents—the said dies being movable parts—supported by springs."

66. For an *Apparatus for Hitching Horses, Clothes Lines, &c.;* Edward S. Boynton, East Hartford, Connecticut.

Claim.—"The application of a cam shaped lever for horse hitches."

67. For an *Improvement in Rotary Pumps;* Charles N. Clow, Port Byron, N. Y.

Claim.—"The roller."

68. For an *Improvement in Rotary Steam Engines;* James M. Colman and Thomas Turton, Milwaukie, Wisconsin.

Claim.—"The engine, composed of the rotary piston, struck from three centres, and the three oscillating abutments, with packing pieces at one end of their concave faces, arranged and operating in connexion with the piston in a cylinder."

69. For an *Improved Machine for Rounding and Backing Books;* John E. Coffin, Westbrook, Maine.

Claim.—"The follower clamp, formed by the stationary jaw, and sliding jaw, and the sliding bed, with hammars attached."

70. For a *Tool for Index Lettering;* Edward Crawley, Cincinnati, Ohio.

Claim.—"1st, The arrangement of a circular revolving head, having around its periphery a series of types, adjustable radially, so as to print an index of greater or less 'display,' by a single rapid continuous movement, using for such purpose the pair of disks, of which one has radial grooves holding a set of types, notched transversely to receive the spiral flanch on the other disk, in combination with the securing and tightening nut upon the arbor and pivot. 2d, I claim, in this connexion, the inking apparatus, having two or more inking rollers, and the distributing mechanism in a vibrating head attached, and supported, to a sliding bar."

71. For an *Improvement in Smut Machines;* R. M. Dempsey, Indianapolis, Indiana.

Claim.—"The concave head, having vertical rods or spikes attached and fitted within an inverted conical screen—the head having wings attached to its underside, and its upper surface corrugated."

72. For an *Improved Stave Jointer;* J. K. Derby, Jamestown, New York.

Claim.—"The vibrating or lifting bed, fitted or pivoted to a bar within the carriage—the bed being operated by the pattern, or its equivalents."

73. For an *Improvement in Securing Pearl Ornaments in Handles of Cast Metal;* Charles Dickinson and Wm. Bellamy, Newark, New Jersey.

Claim.—"Inserting or securing the pearl disks or plates in the handle, by placing the pearl disks in grooves formed in the moulds—the pearl disks having thimbles fitted within them, so that the metal will close around the thimbles."

74. For an *Improved Shutter Operator;* Charles R. Edwards, Niagara City, N. Y.

Claim.—"1st, The tapered or rolling tapered cogs, arranged on the underside of a wheel, or segment of a wheel, so as to mesh with a screw shaft, or spiral thread. 2d, The tapering of the cogs, in a direction towards any practical point between the centre of the wheel and the casing, and so as to mesh with a spiral thread; but I do not confine myself to any particular shape or position of said cogs, or direction of their taper; for cogs might be made to operate nearly in the same manner on the upper side of the wheel, or on a slightly bevel edge of the wheel. 3d, The meshing and operating a screw shaft or spiral thread, with cogs on a wheel, or segment of a wheel, used with the before described combination, and for opening, shutting, and staying the blind, and opening, shutting, and staying the lattice. 4th, The constructing of the shaft in two parts, so that one part may be pushed in, so as to unite or mesh with the other, and slide together, so as to shorten or lengthen the shaft. 5th, The piece, or its substitute, and the plan of the enclosure for holding the screw. 6th, The general plan of opening, shutting, and staying the lattice by means of the knee lever, and with the combination operated by a slight turn of the knob crank."

75. For an *Improved Mode of Attaching Shafts to Vehicles;* Francis J. Flowers, Brooklyn, New York.

Claim.—"The rod on the goose neck or bar, fitted in the eye on the bar; the cap attached to the bar, and the nuts on the rod—the nut having flanches attached to them, and fitting over circular or annular edges on the ends of the cap and eye."

76. For an *Improved Machine for Quarrying and Cutting Stone;* Charles Frost and A. W. Webster, Waterbury, Connecticut.

Claim.—"The combination of the cutter stocks or blocks, and cam—the stocks or blocks being pivoted to the pulley, which is placed on a shaft in the frame, and the cam placed loosely on the shaft."

77. For an *Improvement in Machinery for Felting Hat Bodies;* William Fuzzard, Cambridgeport, Massachusetts.

Claim.—"The apron connected to the vibrating or reciprocating roller, or cylinder, and to the adjustable platform, and arranged in relation with the reservoir, or box."

78. For an *Improvement in Fire Arms;* James E. Halsey, City of New York.

Claim.—"The tube, constructed of such a length, and placed in such a position, that it shall serve as a means for communicating fire from the cap to the forward end of the charge of powder only."

79. For an *Improvement in Brick Machines;* James A. Hamer, Reading, Penna.

Claim.—"The adjustable segment of the guide plate, in combination with the plungers. 2d, Also, dusting the moulds of the mould wheel with fine dry sand, preparatory to their being filled with clay, by means of the arrangement and combination of the blower or fan, the sand box, the shaker board, the arm, weight ball, and shaker rod. 3d, Also, the sliding gate, so constructed and operated by means of a small roller, running in the guide plate, that the mould is filled at the end by means of the screw in the shell, while the wheel is in operation; said gate being closed while the mould is filling, and open during the discharge of the brick."

80. For an *Improvement in Curry Combs;* Asahel A. and Andrew Hotchkiss, Sharon, Connecticut.

Claim.—"The turning of solid corners upon the shell to save riveting, and the serrating of the ends of the shell, to form teeth thereon—the corners of the plate being first scalloped out, so as not to project beyond the teeth, after they are bent up into shape."

81. For an *Improvement in Looms;* Wm. J. Horstmann, Philadelphia, Penna.

Claim.—"The permanent attachment of the pile wires by one end, to independent sliding rods, which are carried each on one side of the warp, and controlled by springs, in such a manner as to allow them an independent movement longitudinally to the warp, by transversely sliding bars—the said rods, bars, and springs, being operated and operating in combination with each other. Also, the spring latches, acting in combination with the rods of the pile wires."

82. For an *Improvement in Reversible Horse Power;* Philip H. Kells, Hudson, N. Y.

Claim.—"Constructing the machine, so that the shaft of the over-reaching belt pulley may be reversible, when the gear wheel shall be shifted to, and secured upon the opposite ends of its shaft, and that in every such position of the pulley shaft, the end of the gear shaft, and the fastenings therein, shall be within the plane of the inner side of the arms, spokes, or face of said pulley; the gear wheel fastenings being the same on both ends of its shaft, and so related to the pulley shaft, that the converge gear shall duly mesh with the pinion of said shaft, at each change of position of these several parts, for the purpose of changing from a right to a left hand machine, or the reverse."

83. For an *Improved Wheel for Steam Carriages;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The combination of the tire, angle tire, sectional tire, cross spokes, and jamb nuts."

84. For an *Improved Arrangement of Means for Balancing and Propelling Life and Property Saving Vessels;* James Minifie, Baltimore, Maryland.

Claim.—"The arrangement of the driving wheels, the steel foundation piece, and the rods and brass connected therewith, and with the propellers in relation to the vessel."

85. For an *Improved Stone Sawing Mill;* C. A. Mills, Dubuque, Iowa.

Claim.—"Operating the saws when arranged upon the top of the frame, so as to work at right angles to each other, by means of the feed plate and knuckles, in combination with the mechanism for elevating the block of stone."

86. For an *Improved Apparatus for Raising and Dumping Coal;* Ephraim Morris, Bergen, New Jersey.

Claim.—"The pulleys, geared together so as to prevent the rope slipping, when combined with the ratchet wheel, pawl, and stop, whereby the bucket is sustained in its elevated position, while being drawn along in either direction, and can only be lowered when the pawl is disengaged from the ratchet wheel. Also, the bails, fitted with hooks, to take the loops on the bucket when the same is elevated, and dump the contents thereof, by drawing up said bails. Also, the adjustable rope, with its knot or projection, for taking the traveler, and through the chains and pulleys or drums, drawing up the bails by the motion of the car, and dumping the contents from the bucket."

87. For an *Improved Dove-tailing Machine;* Lysander A. Orcutt, Albany, N. Y.

Claim.—"The combination of the double frames or carriages, for producing the canting or rocking, and the vertical or horizontal motions for cutting dove-tails and tenons, or counters. Also, the variable dog and pattern for spacing, regulating, and holding the stuff under the action of the cutter."

88. For an *Improved Shingle Machine;* Adrian V. B. Orr, Lancaster, Penna.

Claim.—"1st, Combining in a single reciprocating plate, a straight face, a tapering face with an offset between them, and a movable frow. 2d, The compound lever, for the purpose of taking the finished shingle off the plate."

89. For an *Improvement in Tanning Hides;* Samuel W. Pingree, Methuen, Mass.

Claim.—"I claim, when the hide is to be tanned with the hair either on or off, as the case may be, removing, or skiving off the inner layer thereof; or the same and a part or parts of the middle lair of it, preparatory to immersing such hide in the tanning liquor."

90. For an *Improved Method of Guiding Circular and other Saws;* Orrin Rice, Cincinnati, Ohio.

Claim.—"The application of the spring in any shape or form, to any anti-friction substance, to be applied directly against the saw; and by traversing over the uneven surface thereof, preventing the saw from trembling; and for strengthening, steadying, and guiding the same while in motion, thereby enabling a much thinner saw of the same diameter to be used, than otherwise could be, without the application of my improvement—thereby effecting a great saving in power, timber, and repairs. Also, the application to govern the side moving or lateral motion of large saws, for sawing logs, occasioned by the springing of the same."

91. For an *Improvement in Locomotive Reflector Lamps;* F. J. Seymour, Waterbury, Connecticut.

Claim.—"Constructing the reservoir of locomotive lamps, so that the reflector be-

comes one side of said reservoir, for the purpose of heating the contents thereof, and rendering the same liquid and limpid. Also, constructing the reservoir of locomotive lanterns, by means of a case surrounding the whole reflector, and provided with the air-tight screws, so as to cause said reservoir to become a self-supplying fountain to the burner tube. Also, regulating the supply of oil, or other burning material, to the flame of a lamp, or shutting off said supply, by means of compression on the wick by the cock. Also, placing the chimney to the rear of the vertical line, over the flame, when the draft is supplied at or near the front of the reflector."

92. For an *Improved Horse Shoe;* Sewall Short, New London, Connecticut.

Claim.—"The combination of the cap and shoe, made in two separate pieces—the cap and shoe being constructed separately. I also specially claim the rib and groove, attaching the cap and shoe."

93. For an *Improvement in Breech Loading Fire Arms;* William Mt. Storm, City of New York.

Claim.—"1st, The arrangement of a portion of the barrel at the rear, sufficient to contain the charge, to swing by a hinge upon the exterior, (as quite distinct from *oscillating* upon trunnions,) out from the line of the bore, for the most convenient insertion of the charge, in combination with the stationary wedging incline at the rear, with which it is made to correspond, and which receives the recoil. 2d, I also claim, in combination with the so hinged chamber, the long tapering valve face, projecting across the joint, so far as, by itself, to bolt the chamber into the barrel to such an extent, that no lateral force or blow can displace it from the exact line of the bore, or (as would be the case with an 'obtuse angle' of valve face,) *wedge* the face of the valve laterally against its seat, while at the same time, the taper of said valve face shall be such, in relation to the joint of the finger, that it shall swing out of and into its seat, without slide upon the latter. 3d, Making such valve face upon the end of a loose tube, of some hard unplastic metal, projecting or extending back into the loading chamber, of which it constitutes an essential and permanent part; and of such strength and thickness, that it shall effectually resist any change of size or form by the force of the explosion or expansion thereby, outwardly against the interior of the chamber, by which its freedom to drive bodily forward, as designed in the manner of a poppet valve, into its seat by the force of the explosion, to close the joint, would be prevented, said tube being found open to the full size of its bore at both ends, and thereat slightly exceeding in bore the bore of the gun. 4th, Extending the rear of the so constructed tube so far back into the chamber, and as farther, that the annular edge of its open rear shall terminate opposite to, or slightly in front of, the point of first ignition of the cartridge—so that while its end at this point terminates, and fits closely against the cylindrical sides of the chamber, to prevent the explosion from passing between them, the edge of its end, or the annular surface facing rearward, being purposely exposed to the forward force of the explosion, the tube will be forced ahead to close the joint between the chamber and barrel, at the earliest instant of discharge, to the end, that if the ball should be a loose fit in the tube, and at the same time not a 'Minnie,' and thus permiting escape of gas past it, before it reached and tightened in the creases, the gas should not be left free to pass through the valve joint, causing 'cutting.' 5th, In combination with my tube, a finger or edging of soft metal, soldered to its rear annular edge, and beveling off rearward thinner than the tube itself, so that the thinner edge shall be easily driven by the explosion slightly forward and outward, into the annular corner, formed by the edge of the tube and the side of the chamber, closing the joint between them tightly at this point, but leaving them elsewhere a loose fit, while each thin edging of soft metal cannot have stiffness sufficient to prevent both it and the valve from being freely driven forward in the chamber by the explosion. 6th, The bolt projecting through the recoil bearing into the breech, and so connected with the lock that it must move continuously and simultaneously with the hammer, and, therefore, the fall of the hammer upon the cap being, under all circumstances, made dependent upon the bolt, having properly entered and secured the chamber, while, moreover, by this means, the bolt which might otherwise be prevented from flying forward into the breech by rust or dirt, is thus forced home by the whole power of the lock. 7th, Tapering the forward end of said bolt beneath, that, if the chamber is not quite home to its place when the trigger is pulled, the bolt will bring it so, before the hammer reaches the cap. 8th, Connecting said bolt with the 'tumbler,' by the slotted head, embracing the headless stud or screw in the tumbler, so that there being no actual attachment of the bolt and the lock, the latter may be removed in the ordinary way, without regard to the former. 9th, Cutting away the recoil bearing below the

centre of the bore, to insure that the explosion shall tend to throw the chamber more tighly down into the stock, in lieu of any chance tendency upward out of its seat. 10th, The fixed unyielding stud and bearing screw, for receiving the force of this downward action, that it may not be exerted upon the underside of the valve face. 11th, Forming the recess in the stock beneath the chamber, to receive any powder spilled in loading with a 'broken' or leaky cartridge, so that it shall not block under the chamber, and prevent it coming down to a horizontal line and in contact with its bearing. 12th, The arrangement of the hinge of the chamber upon the top of the latter, in lieu of elsewhere, whereby the chamber is thrown over in the most elevated and unobstructed position, for the insertion of the cartridge, while the barrel will then bear the weight of the chamber (when open), and not the joint of the hinge, and the steel need not be cut away and weakened, as would be the case if the chamber swung laterally, and at the same time the hinge can constitute the 'crotch' sight. 13th, Making said hinge a spring, and so arranged as to yield in case of any obstruction tying or adhering in the valve face. 14th, Swiveling the chamber, so that when open it may be twined with its mouth vertically, for convenient loading with loose ammunition, while the weapon lies horizontal," &c.

94. For an *Improvement in Brushes for Dressing Warps;* Samuel Taylor, Cambridge, Massachusetts.

Claim.—"My improved warp dressing brush, as made with the external ends of its bristles cut slantwise, or leveled with respect to their stocks, for the purpose of enabling the warps to centre the brush with more facility than should be the case were the points cut off square, in the usual way."

95. For an *Improved Water Wheel;* John Tyler, West Lebanon, New Hampshire.

Claim.—"1st, Giving the head of my improved water wheel an upward curvature from centre to circumference. 2d, The peculiar shape and position of the series of buckets within the wheel, viz: the convex surface of each bucket having the shape of the segment of a circle, whose radius is one-third longer than the radius of the wheel, whilst the said buckets are so arranged, that the convex surface of each bucket is tangential to an imaginary circle, whose centre is the centre of the wheel, and whose radius is one-third the length of the radius of the wheel. 3d, Also, connecting the lower edges of the buckets to each other, by means of a scolloped ring, of such a shape that the water will be conducted from the scroll-shaped water way, directly against the central portion of the convex surfaces of each bucket, and then pass freely downwards between the buckets."

96. For an *Improved Turning Machine;* Elbridge Webber, Gardiner, Maine.

Claim.—"The arrangement of the frame containing the pattern and turning centres, relative to the gauge rod and cutter carriage, whereby the said frame may be fixed, and the carriage movable, or the reverse, so that a fac-simile or a reverse pattern may be used, without any change in the machine."

97. For an *Improvement in Raking Attachment for Harvesters;* C. Wheeler, Jr., Poplar Ridge, New York.

Claim.—"The disk, with teeth attached, and gearing into a pinion in the shaft of the pulley, in combination with the cam, rod, and guides or ways, between which the slide, to which the rake is attached."

98. For an *Improved Hand Printing Press;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—"The arrangement of the distributor and inking roller to the platen, and the said distributor actuated by the lever and link only when said lever is made to actuate the vibrating shaft, when said shaft is provided with the cams for pressing down or operating the platen."

99. For an *Improvement in Machinery for Cleaning the Top Flats of Carding Engines;* Horace Woodman, Biddleford, Maine.

Claim.—"1st, The arrangement of gears on the cleansing frame, and in combination therewith, the studs or pins on the inner sides of said gears, and the levers, and the sliding bars, operating together with the slotted or corrugated arches or flanches. 2d, The said slotted or corrugated arches, whether cast with the main frame of the card or attached thereto; and this I claim, as a means of holding the cleansing frame in place, while the top cards are raised, stripped, and depressed, and also, as a means of regulating the reciprocating movements of said traverse or cleansing frame, from one side of the card to the other, and also from one card to any other. 3d, The combination of

the lever and stripping rod, with its dogs and sliding clutch, arranged to reverse the motion of the cleansing frame. 4th, The arrangement of the waste pan, with a narrow bar and strip of filleting attached to the front edge of the pan, so placed as to remove the waste from the cleansing bar, to produce a clean brush bar for the cleansing of each top card."

100. For an *Improvement in Knitting Machines;* James B. and Walter Aiken, Assignors to Herrick and Jonas B. Aiken, Franklin, New Hampshire.

Claim.—"1st, The hollow circular needle plate, having grooves cut in its inner surface. 2d, The horizontal groove near the bottom of the cone, so arranged in relation to the inclined operating groove, that the needles may be retreated thereto, and retained therein, when they are not wanted to operate on the fabric knit. 3d, The switch, arranged to change the needle from the inclined operating groove to the retreating groove."

101. For an *Improvement in Jacquard Looms;* John Goulding, Worcester, Mass.; patented in England, Nov. 22, 1855.

Claim.—"1st, The combination and arrangement of the mechanism for operating the suspension and trap boards in jacquard looms, that is to say: lever, sector, or shaft pulley on shaft, connected by a chain or belt having slots, suspension, and trap board, connected to the lifting rods by arms. 2d, The lever, or its equivalent, operated by the tappets, or their equivalents, so arranged as to lock the beams or straight and ground warps. 3d, The mode of giving tension to the warp threads or yarn taken from bobbins, as shown by drawing it against itself or the bobbin or yarn which remains upon it by means of a weight, or its equivalent, but so arranged as to be lifted by the yarn when it is drawn, and release the bobbin, and allow it to turn until the yarn delivered permits the weight to descend again, and stop the bobbin by the friction of the weighted yarn against it. 4th, The traversing board, or its equivalent, arranged upon the knot cords or pile, or figuring harness below the warps, to bring down any single cord which may catch accidentally, so as not to be brought down by its own weight. 5th, Holding the parting by hanging them to a rod in rear of the heddles, and passing them between the upper and lower loops of the heddles. 6th, The trap boards pierced in the manner combined with needles. 7th, The thimble or socket, or its equivalent, for receiving, stopping, and holding the shuttle in the box. 8th, The apparatus for holding and drawing up the filling or binding weft, for the purpose of tightening the selvage. 9th, The arm to carry the weft thread from the fell at the edge of the cloth, nearly to where the pile warp crosses or makes an angle with the shed. 10th, I am aware that a knife, revolving on an endless belt, has been used; I, therefore, do not claim this feature, but I claim the application of the knife, in combination with its guides."

102. For an *Improved Automatic Cannon;* Charles E. Barnes, Lowell, Mass., Assignor to self, and Moses W. Oliver, Manchester, N. H.

Claim.—"The arrangement by which I impart a reciprocating and intermittent motion to the breech pin by gears, so that the gun or cannon may first receive the cartridge, bringing the nipple on which the percussion cap is placed in the centre, and immediately back of the end of the cartridge, ready for firing. Also, giving the ramrod plunger a reciprocating and intermittent motion for placing the cartridge within the gun, and firing it when so placed, by means of a hammer in the plunger, operated by spring and latch. Also, the cap-wheel and its slide rods, so arranged and operated, as to place or deposit the cap upon the nipple when the breech pin is drawn back, so that it can then be advanced or slid into the gun with the cap placed on the nipple therein, ready for firing. Also, the cartridge box, so arranged and operated by the breech pin, or otherwise, as to deposit the cartridge into the receiver, ready for the plunger or ramrod to force it into the bore of the gun. Also, the catch, or its equivalent, on the latch or otherwise, formed, arranged, and operated to stop the movement of the firing apparatus, to prevent accidents, and clogging the cannon with surplus ammunition."

103. For an *Improved Base Damper for Melodeons, &c.;* Riley Burditt, Assignor to Jacob Esley and Hartsel P. Green, Brattleboro', Vermont.

Claim.—"The base damper, applied under or within the swell, in combination with the lever and spring, so that it may be opened at the pleasure of the player, or remain closed while the swell is opened."

104. For an *Improved Mode of Constructing Dams;* Waldo P. Craig, Assignor to self, and Wm. R. Rightor, Newport, Kentucky.

Claim.—"The construction and application of the follower piles, each pile being

formed from a plank having tapering sides and parallel edges, with a slanting termination at the thin end, running to one end, and chamfered on each side of the slant, and with the batten, or its equivalent, pointed from both edges, and chamfered from its outer side, one edge of the batten projecting beyond the longer edge of the pile, so as to form a rebate, fitting and over-lapping the edge of the preceding pile."

105. For an *Improvement in Cooking Stoves;* Henry S. George, Assignor to self and George Gratton, Syracuse, New York.

Claim.—"The arrangement of the air flues, through and around the fire chamber, and the hot air channel between the oven plates and the passage for the products of combustion, with the dampers for supplying the fire draft with hot air."

106. For an *Improvement in Sounding Guards for Vessels;* John Guest, U. S. N., Washington, D. C.

Claim.—"The mechanical construction of the machine, and especially the attachments of the radius bars, working in the grooves, by which I am enabled to indicate the approach of shoal water, whether the vessel be going ahead or astern."

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107. For an *Improved Straw Cutter;* Warren S. Bartle and Ebenezer Vaughan, Newark, New Jersey.

Claim.—"The mode of operating the knife, by means of the lever and secondary pitman, in combination with the knife and main pitman; by which a variable downward drawing stroke is effected."

108. For an *Improvement in Ploughs;* Alvin Barton, Syracuse, New York.

Claim.—"Jointing the upper and front points of the body of the plane to the coulter."

109. For an *Improvement in Corn Planters;* M. Bemis, Lyme, Ohio.

Claim.—"Arranging the frame upon the axle and wheels, and connecting the point of draft behind and below the axle, and in combination with the arm and pins."

110. For an *Electro-Magnetic Fog Bell;* A. Barbarin and B. F. Simms, New Orleans, Louisiana; patented in England, August 17, 1855.

Claim.—"The application of electricity and magnetism to the ringing of fog bells."

111. For an *Improvement in Means for Controlling Feed-water Apparatus of Steam Boilers;* Benjamin F. Bee, Wareham, Mass.

Claim.—"Controlling the feed-water apparatus of steam boilers by the float, and the intermediate means, or their equivalents, between it and the feed-apparatus, and connected with the counter balance, or not."

112. For an *Improvement in Nutmeg Graters;* George Blanchard, City of New York.

Claim.—"The application and arrangement of the self-sliding grater, in connexion or inside of the hollow cork-screw handle or tube, so that when the whole structure is shaken with one hand, the nutmeg is grated by the sliding grater."

113. For an *Improvement in Rope Machines;* Thomas G. Boone, Brooklyn, N. Y.

Claim.—"1st, The arrangement of the strand spindles, with their axis all in the same line with each other and with the axis of the laying spindle—whereby I am enabled to put in a forehard equal in turn to that of the lay, without rotating the strand spindles. 2d, The arrangement of gearing, whereby, during the rotation of the laying spindle, the strand spindles may be kept stationary, or have a slight rotary motion imparted to them, either in the same or in a contrary direction with the laying spindle; consisting of the stationary gear, the shafts with their gears, and the gears on the strand spindles. 3d, The conducting tubes furnished with rollers, or their equivalents, revolving around the axis of the laying spindle and spool spindles, and rotating at the same time on their own axis, operating in continuation with the arrangement of strand spindles, to take out the first additional twist received by the strand, and carry it forward to produce a forehard in the rope."

114. For an *Improved Method of Turning Ornamental Forms;* P. C. Cambridge, Jr., Enfield, New Hampshire.

Claim.—"The sliding carriage with tools attached to it—the carriage being fitted

transversely on a carriage. Also, the carriage, in combination with the collar and cutters, when the above parts are placed on the carriage. Also, the polygonal notched bar or gauge rack, by which the movement of the carriage is regulated, according to the character or nature of the work to be done, and the stuff beaded in the desired manner."

115. For an *Improved Marble Sawing Machine;* Ira Carter, Malone, New York.

Claim.—"Giving the saws a lateral vibrating motion while the saw frame or gate is being operated, by means of the rods attached to sliding frame, in combination with arms, levers, and racks."

116. For an *Improved Machine for Striking Unburnt Brick;* Marinus P. Crapo, Humboldt County, California.

Claim.—"Operating the follower and striker."

117. For an *Improved Self-Setting Tail Block for Sawing Mills;* Joel Dawson, Barnesville, Ohio.

Claim.—"The bent or curved lever, with pawl secured to it, adjustable block with the screw and oblique board attached, and the sliding block with rack secured to it."

118. For an *Improvement in Fire Backs for Fire Places;* Samuel M. Echols, Lafayette, Indiana.

Claim.—"Dividing the spindle diagonally, and providing a screw-hole in one end of each of its sections, at right angles to the division line."

119. For a *Straw Cutter;* Cotton Foss, Painesville, Ohio.

Claim.—"The stationary arm, friction roller, and inclined track."

120. For an *Improved Cutting Device for Harvesters;* Carlos W. Glover, Roxbury, Connecticut.

Claim.—"The oscillating or rocking cutters placed within the fingers, and used in connexion with the sickle."

121. For an *Improved Stone Dressing Machine;* A. M. George, City of New York.

Claim.—"An improvement on the stone dressing machine of Nichols & George, patented December 18, 1855. Also, the toggle, with the rollers and knives or cutters attached, in combination with the rotating shafts, with the adjustable arms upon them."

122. For an *Improved Collodeon for Photographic Pictures;* Victor M. Griswold, Lancaster, Ohio.

Claim.—"The addition of albumen to collodion."

123. For an *Apparatus for Slaughtering Hogs;* Thomas J. Godman, Madison, Ind.

Claim.—"The horizontal revolving wheel or frame, provided with hooks on its periphery, arranged at or near the scalding bench, and used to transport and transfer the hogs from the bench (on which they are deprived of their hair by pulling and shaving,) to the scraper down gutter washer out of the inside: and off-beams, which hang them in the drying room, holding the hogs convenient to each laborer in succession, a proper time for him to perform his allotted or respective portion of the slaughtering process."

124. For an *Improvement in the Frames of Mowing and Reaping Machines;* Moses G. Holland, Penn Yan, New York.

Claim.—"The cylindrical conical formed metallic frame, as a support for the running gear and finger bar, when constructed, arranged, and combined therewith. Also, in combination with said cylindrical or conical metallic frame, the step or brace frame."

125. For an *Improvement in Railroad Car Wheels;* A. C. Ketchum, City of N. York.

Claim.—"Connecting the hub and rim of the wheel by fitting a flanch attached to the hub, within a flanch attached to the rim, providing the said flanch with a shoulder and groove, and applying a divided clamping ring to the said groove."

126. For a *Machine for Composing and Distributing Type;* Julius J. Koenig, Chicago, Illinois.

Claim.—"The arrangement of parts, for the purpose of composing and distributing type."

127. For a *Mode of Tinting Photographic Pictures;* Giles Landell and Marcus A. Root, Philadelphia, Pennsylvania.

Claim.—"The application of coloring substances or matter, to photographic impressions or pictures upon glass or metal, or other material."

128. For an *Improved Straw Cutter;* Oren Moses, Malone, New York.

Claim.—"Constructing the auxiliary cylinder of an iron skeleton, combined with fillings of wood, horn, or other suitable material, when the shaft of said cylinder is secured to its driving pinion in such a manner, that the relative position of the cutting cylinder and the auxiliary cylinder can be so adjusted, as to cause the edges of the knives in the former to act equally and uniformly upon every portion of the face of each of the fillings in the latter cylinder, for the purpose of preventing the formation of deep channels in said fillings."

129. For an *Improved Sash Lock;* Lucius Paige, Cavendish, Vermont.

Claim.—"The combination and arrangement of the weighted arm, the rack, the sectoral gear or pinion, the stopping arm, and the stop shoulder, as applied to the bolt and within the case thereof, and so as to operate together and actuate the bolt."

130. For an *Improvement in Ploughs;* John Rich, Kingsbury, New York.

Claim.—"The socket, when arranged and combined with the body of the plough."

131. For an *Improved Three-wheeled Pleasure Carriage;* Cyrus W. Saladee, Columbus, Ohio.

Claim.—"The longitudinal braces, in combination with the double circle, by which means the third wheel is firmly connected to the hind axle and wheels."

132. For an *Improvement in the Adjustment of Mill Stones;* J. G. Siemers, St. Louis, Missouri.

Claim.—"Supporting a stationary stone upon a series of elastic and readily adjustable bearings, when the said stationary stone is combined with a running stone, which rests upon a series of elastic and readily adjustable bearings, which are combined therewith, and with the spindle or shaft of the same, in such a manner, that the faces of said stationary and running stones are enabled to mutually self-adjust themselves to each other, and are also enabled to be adjusted."

133. For an *Improvement in Fire Arms;* George H. Soule, Jersey City, N. J.

Claim.—"The use of the facings of copper, or other equivalent tough metal, less oxidizable than steel or iron, by the action of the heat and sulphur gases caused by the explosion of the powder, in combination with the breech piece and charging chamber."

134. For an *Improvement in Making Seamless Metal Tubes;* J. J. Speed, Jr., and J. A. Bailey, Detroit, Michigan.

Claim.—"The three encircling and radially hammering or pressure dies when arranged relatively to each other, and operating together on the tubular ingot while stationary, and in combination with the intermittent feed to the ingot or partially formed tube on or over the mandrel, alternate with the compressive action of the dies."

135. For an *Improvement in Machines for Threshing and Cleaning Grain in the Field;* George W. Swift, Oxford, Mass.

Claim.—"The pinions and pulleys, in combination with the traveling wheels; the double axles and the pivoting attachment for giving the driving pulley an accelerated rotation, from the rotation of the traveling wheels, either by the forward motion of the machine, or by a circular motion about its attachment."

136. For an *Improved Cattle Stall;* Hiram Tarbox, 2d, Tremont, New York.

Claim.—"Having attached or supported an apron, or its equivalent, whereby the excrement is prevented from dirtying the animal, and also protecting litter or bed."

137. For an *Improvement in Detachable Shaft Coupling;* Peter Teal, Philadelphia, Pennsylvania.

Claim.—"The plate or ring, for the purpose of operating the coupling of the shafts and also for releasing the coupling."

138. For an *Improvement in Mop Heads;* Hiram Thompson and Richard Q. Tuson, Lebanon, New Hampshire.

Claim.—"Firmly securing the binder in any desired position by the joint action of the cam lever and the spring, when the former is combined with the binder ring, and the latter with the mop handle."

139. For an *Improved Washing Machine;* H. H. Torrey, Buffalo Grove, Illinois.

Claim.—"The rotating reciprocating disk, placed within the tub and upon the arbor or shaft, when said disk is provided with pins or pegs on its under surface, and the bottom of the tub with radial rubbers."

140. For an *Improvement in Mowing Machines;* John W. Thompson, Greenfield, Massachusetts.

Claim.—"Connecting the cutter plate box to the after ends of freely vibrating arms, in combination with the rectangular frame and the inwardly projecting and sustaining arm, when the said parts, together with the cutter plates and their gearing, are arranged in relation to the main wheel."

141. For an *Improvement in Car Coupling;* John B. Witherle, Upton, Mass.

Claim.—"Applying the sliding retracter and the curved graspers together, so that the fulcrum of the latter shall be movable with the retracter, and the whole be made to operate in other respects."

142. For an *Improvement in the Mode of Regulating the Conical Pendulum of Time Keepers;* John C. Briggs, Concord, New Hampshire.

Claim.—"The application of friction to conical or rotary pendulums, to keep them revolving very nearly in any desired circle."

143. For an *Improved Mode of Charging Cannon;* Josiah Dodge, Dummerston, Vt.

Claim.—"The arrangement of the spring, guide pin, openings, and forked lever, for the double purpose of revolving and guiding the tubing on the periphery of the wheel to the ends of the cannon barrel."

144. For an *Improved Printer's Composing Stick;* Oliver F. Grover, Middletown, Connecticut.

Claim.—"The application to the composing stick of the guide, to prevent the slide and the bed from separating while adjusting the composing stick, and the clasp to secure and hold the slide in its place when adjusted; using for that purpose the aforesaid guide and the clasp."

145. For an *Improvement in Centrolineads;* W. Jose von Kammerhueber, Washington, D. C.

Claim.—"The combined T square and centrolinead, in connexion with the circular arcs of different diameters, and of any suitable material, provided on their ends with pins, or their equivalent, to secure them to the drawing board, when used to guide the centrolinead."

146. For an *Improvement in Preparing Vegetable Dye-Stuff;* Frederick E. Schmidt, City of New York.

Claim.—"The treatment of the juice previous to its use for dyeing, to produce permanent and durable colors."

147. For an *Improvement in Fenders for Fire Places;* John W. Truslow, Lewisburg, Virginia.

Claim.—"The hinged folded screen or fender, within the recess in the jambs, in combination with the spring in rear of the screen, and the sliding panel in front of the same."

148. For an *Improved Filtering Medium;* Wm. Wickersham, Boston, Mass.

Claim.—"1st, The use of the disk in water filters, formed of flattened wire or narrow strips of metal, grooved transversely by either milling or engraving, in such a manner, that when said strips are formed or wound into a disk, said grooves will form apertures for the water or other fluids to pass through said disk in the process of filtering. 2d, The method of making the filter disk less liable to injury, and more firmly, by inserting pins rom the edge to or nearly to the centre through the different layers of metallic strips of

which it is made, to hold them in their places; this method of fastening the disk together I claim, only in combination with the spiral filter disk."

149. For an *Improvement in Lard Lamps;* J. S. Senseny, Assignor to self and G. H. Merklein, Chambersburgh, Pennsylvania.

Claim.—"The arrangement and construction of a lamp."

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150. For *Improved Cutter Heads for Planing Machines;* Lewis M. Berry, Boston, Massachusetts.

Claim.—"The application and use of the pieces."

151. For an *Improved Mode of Attaching Sleigh Bells to Straps;* Abner G. Bevin, Chatham, Connecticut.

Claim.—"Making the bell without shanks, and having holes made through them to receive the staples which pass through the straps and cover."

152. For an *Improvement in Door Knobs;* Jeremy W. Bliss, Hartford, Conn.

Claim.—"The employment of the intermediate piece, having a cut or racked surface, corresponding to and secured upon the spindle by the set screw at any desired point."

153. For an *Improved Method of Driving Circular Saws;* John Broughton, Chicago, Illinois.

Claim.—"The sliding frame, placed and working between the horizontal and segment guides or ways in the frame—the frame having the saw placed within it, and driven by the belts from the shaft, arranged relatively with the frame."

154. For an *Improvement in Fixed Cartridges;* George Buckel and Edward Dorsch, Monroe, Michigan.

Claim.—"1st, The arrangement side by side in the same cartridge, and with their axes in the same circle, of a number of balls of cylindro-conoidal, or other partly cylindrical form, said balls being of a size to fit each to a separate groove of a circular grooved barrel. 2d, The employment of a single partition piece, to separate each and all of the balls, for the prevention of their union by fusion, when the charge explodes."

155. For an *Improvement in Percussion Tape Primers;* James Chattaway, Springfield, Massachusetts.

Claim.—"The improvement of substituting for paper, metal hermetically sealed, and soldering of the continuous band, so as to make it impervious to water, weather, or climate."

156. For an *Improvement in Vibrating Steam Engines;* William Darker, Jr., West Philadelphia, Pennsylvania.

Claim.—"The oscillating piston, arranged within a steam box, which is provided with a partition and with suitable packing, and with a suitable arrangement of a valve or valves and passages, the whole operating in connexion with suitable means of converting the oscillating movement of the piston into a continuous rotary motion."

157. For an *Improvement in Artificial Hands and Arms;* John S. Drake, Boston, Massachusetts.

Claim.—"The ratchet and pawl in the elbow-joint, to sustain the fore arm at the proper position relatively with the stump. Also, the construction of the wrist-joint with the slots and stops for allowing the necessary motion. Also, forming the knuckle joints and the joints between the different parts of the fingers and thumb with ratchets and pawls, so as to secure said joint at the point to which they may be moved in adjusting the fingers or thumb to any given article or purpose. Also, disengaging the pawls from their respective ratchets, by means of the sliding cross-bar, (actuated by competent power,) rods, and cam pieces. Also, the arrangement of the bars, crank, button, and rod, for actuating the bar and rods. Also, in connexion with this arrangement, the cross lever for actuating the bar pawl of the thumb."

158. For an *Improvement in Self-Acting Electric Telegraphs;* Moses G. Farmer, Salem, Massachusetts.

Claim.—"1st, The method of arresting the motion of the type wheel, by means of

the alternately open and closed keys, in combination with the circuit wheel. 2d, The combination of a straight key board with a circuit wheel, when the two are connected together by means of the wires, whereby the place of making and breaking the circuit may be transferred to the immediate vicinity of the key board. 3d, The method of putting the two machines in correspondence with each other, the current being turned out of the operating magnet of the receiving machine, by means of the regulating key, the arm, insulated spring, and their connexions."

159. For an *Improved Machine for Moulding and Pressing Building Blocks from Clay, &c.;* Ambrose Foster, City of New York, and George M. Foster, Fairhaven, Connecticut.

Claim.—"1st, The sliding hopper, plunger, and vibrating press box, when the above parts are moved or operated relatively with each other. 2d, Operating the hopper, press box, and plunger, by means of the cam on the shaft, the ledgers on the wheel, and levers."

160. For an *Improvement in Machines for Felting Hat Bodies;* Lansing E. Hopkins, Brooklyn, New York.

Claim.—"1st, The combination of the beaters, the revolving belt, and the beater heads. 2d, The adjustability of the beater heads, in combination with beaters having a positive motion."

161. For an *Improvement in Gas Stop-Cocks;* James Humphrey, Boston, Mass.

Claim.—"The mercurial gas-cock, constructed with the adjustable slitted cylinder and the reservoir of mercury."

162. For an *Improvement in Harvesters;* Stephen Hunter, Cortlandt, New York.

Claim.—"The employment or use of the rotating cutters formed of circular plates, with teeth at their peripheries—said teeth working through or between slotted fingers on the plates, when such plates are connected by a hinge or joint, and attached to the frame."

163. For an *Improved Fly-Trap;* Joseph Hyter, Kent, Indiana.

Claim.—"A trap for catching flies, having an opaque front and bottom inclined transparent back, small front decoy passage, grooved bait board and trough."

164. For an *Improved Cutter Stock for Metal Planers;* Joshua Mason, Paterson, New Jersey.

Claim.—"The cutter stock placed within a ring or band, which is suspended by journals within the frame or box—the stock being provided with a sliding or adjustable plate, provided with a slot, and the stock adjusted or operated at the end of each stroke of the bed, by the pins on the side of the bed, and the levers."

165. For an *Improved Machine for Sawing Stone or Marble;* Matthew J. McBird, Logansport, Indiana.

Claim.—"The combination of the turn table and the lateral moving platform or bed, so that when the turn table is revolved the stone or marble will be brought in oblique position under parallel moving saws, while the platform or bed, when that is given a lateral transverse movement to the parallel position of screws, the stone or marble is given a corresponding movement and brought to the position required."

166. For an *Improvement in Cotton Gins;* James B. Miles, Chicot, Arkansas.

Claim.—"The arrangement of the swing board, in combination with the mechanism described, so that the varying size of the roll of cotton in the gin shall govern the feed, and keep it uniform, or nearly so."

167. For an *Improved Polishing Machine;* John Moore, Gardiner, Maine.

Claim.—"The general construction of the machine, having a rubber revolving by power, and so constructed as to be readily applied whilst in motion to all parts of the work as required."

168. For an *Improved Marble Sawing Machine;* John M. Mott, Jr., Lansingburgh, New York.

Claim.—"The use of the adjustable guide bars, guide rods, and slides on the guide bars, or their equivalents, in combination with the slides carrying the saws."

169. For an *Improved Re-acting Water Wheel;* A. Monroe, Worcester, Mass.

Claim.—"The scroll, having the guide or deflecting plates attached to it, the wheel, provided with the concave buckets, and the plates attached to its arms."

170. For an *Improved Method of Tapping Fluids under Pressure;* James P. S. Otterson, Nashua, New Hampshire.

Claim.—"1st, The employment of a chamber of sufficient capacity to contain the cock, together with the necessary tools for inserting the same in any pipe or vessel containing water under pressure. 2d, The employment of the rotary plate, or its equivalent, working in or forming part of the chamber."

171. For an *Improved Valve for Type Casting Machines;* Edward Pelouze, Jr., Philadelphia, Pennsylvania.

Claim.—"In combination with the nipple, the self-acting valve and stoppers."

172. For an *Improved Self-Raker for Harvesters;* Silas G. Randall, Rockford, Illinois.

Claim.—"The railway carriage, when constructed, arranged, and operated in respect to the platform. Also, the method of operating the rake, and giving it at once its transverse and its tilting actions, viz: by the combination with the bent rake shaft and arm of the endless belt and its eye. Also, the combination of the traverse rake, the spring, rods, and the pressing guards."

173. For an *Improvement in Repeating Fire Arms;* C. S. Pettengill, New Haven, Connecticut.

Claim.—"1st, In combination with the arrangement of the main spring to work on a pivot, so as to be capable of relief from all strain, except at the time of firing, the application to the said spring of a spring—operated upon it to draw back and effect the cocking of the hammer. 2d, In combination with the arrangement of the main spring to work on a pivot, I claim the lever and the cam on the trigger, operating together and upon the main spring, to strain and develop the elasticity of the main spring, by the act of drawing the trigger to fire. 3d, The sear as arranged, entirely disconnected from the trigger, and operated upon to set free the tumbler, by means of a cam on the trigger. 4th, The attachment of the dog which operates in the ratchet notches on the cylinder to the same lever by which the strain is thrown on the main spring. 5th, The arrangement of the slot in the recoil shield, and the holes at the end of the ratchet notches on the cylinder—whereby the cylinder is locked so as to be incapable of rotation in either direction, before the hammer is let off."

174. For an *Improvement in Glass Furnaces;* Samuel Richards, Philadelphia, Pennsylvania.

Claim.—"1st, The employment of a series of interior tubes. 2d, The employment, in connexion with said tubes, of vibrating or rotating agitators."

175. For an *Improved Scaffold for Shingling Roofs;* J. W. Rodefer, Abington, Va.

Claim.—"Constructing the scaffold, viz: having the platform hinged to the sleepers or string pieces, and having segment braces attached to the sleepers or string pieces; the braces having holes made through them and passing through the bars of the platform, whereby the platform, by means of pins passing through the holes in the braces, may always be adjusted in a horizontal position, whatever the pitch or inclination of the roof may be."

176. For an *Improvement in Liquids used as a Motive Power;* John C. fr. Solomon, Baltimore, Maryland.

Claim.—"The sulphoil carbonic acid liquid, prepared in combination with carbonic acid, generated in any known way, or other equivalent liquifiable gas as a motive power."

177. For an *Improvement in Riding Saddles;* John C. fr. Solomon and Geo. E. Cooper, Baltimore, Maryland.

Claim.—"The movable volute spring seat, with its guiding rods, and the guides in which the same is moved on the upper sides of the pads, in combination with the supporting rod attached to the underside of the metallic riding seat."

178. For an *Improved Friction Match Machine;* C. D. Smith and H. Patterson, Baldwinville, Massachusetts.

Claim.—"1st, The table, with its plate and pieces, or their equivalents, to carry the

splints from the dies, and place them in the rack. 2d, The peculiar construction of the rack pieces to facilitate their receiving splints, and for the better control of them."

179. For an *Improved Arrangement of Means in Pendulum Pumps for Ships;* J. Stever, Bristol, Connecticut.

Claim.—"Attaching a series of pumps to a hollow shaft, which is allowed to turn freely in its bearing, and connecting the weighted bars to the plunger rods of the pumps, by means of the geared sectors and levers."

180. For an *Improvement in Sewing Machines;* A. Swingle, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The employment of a hook, in connexion with the looping needle, and arranging said hook so that it shall pass into the cloth or material from the same side of it which the looping needle works on is situated."

181. For an *Improved Trigger Protector for Fire Arms;* Bernard H. Westerhood, Philadelphia, Pennsylvania.

Claim.—"The employment, in connexion with fire arms, of a protector, which can be locked so as to entirely enclose the trigger, and opened so as to expose the same."

182. For an *Improved Method of Riving Equal Pieces from a Block;* Henry White, Oneida Castle, New York.

Claim.—"Traversing the block to be split, so that the froe will strike the pieces to be split in the centre, successively to split them. Also, the springs, so applied as to yield when the froe enters the block, and re-act to close the split, when the froe is withdrawn."

183. For a *Machine for Sawing Coopers' Hoops;* James O. Woodward, Taunton, Massachusetts.

Claim.—"The arrangement and operation of two circular saws for sawing irregular or crooked hoop poles—and the two shafts with the saws attached at the inner ends thereof, being placed on an angle, so that two edges of said saws run or operate near together, and the two opposite edges of said saws will run or operate wide apart."

184. For an *Improvement in Relieving Steam Slide Valves from Pressure;* Henry R. Worthington, Brooklyn, New York.

Claim.—"The transferring of steam pressure from the back of a steam slide valve to a fixed point by means of a piston and vibrating link."

185. For an *Improvement in Valves of Accordeons;* C. M. Zimmermann, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the valves of the instrument, in connexion with sliding rollers acted upon by the keys and regulated by stops, for the purpose of producing from the actuating of one key, a variety of different tones, by the simple pressure of the stop."

186. For an *Improvement in Folding Guides of Sewing Machines;* B. C. Boyes, Assignor to self and H. Dercum, Philadelphia, Penna.

Claim.—"The employment of one or more helical or split rings, for the purpose of forming on the edges of fabrics single or double hems, or for forming plaits in the middle of fabrics, previous to the said hems or plaits being submitted to the action of the needle and thread of sewing machines."

187. For an *Improved Planing Machine;* Asahel Lockwood, Chicago, Illinois, Assignor to L. B. Flanders, Cleveland, Ohio.

Claim.—"The support, with its circular dovetail grooves, or their equivalents, attached to the bed piece, together with the vibrating table turning upon the centre pin or king bolt, and in combination therewith, the adjustable guide and the sliding head, so adjusted and combined, that a greater or less vibratory motion can be secured to the table, by means of the adjustable guide, by bringing it out of a parallelism with the ways and the bed."

188. For a *Machine for Sewing Pins upon Paper or any other material;* E. S. Woodward, Winchester, Connecticut, Assignor to James R. Keeler, City of New York.

Claim.—"The roller or separator, made of india rubber or other elastic substance. Also,

the turn-table, for receiving and changing the pin from one place or position to another, or their mechanical equivalents. Also, the combination of one or a series of conductors for supplying pins in any desirable position, and a sewing machine of any suitable adapt ability for sewing pins upon paper or any other material."

189. For an *Improvement in Chairs;* James Fernald, Boston, Mass.

Claim.—"The oval back rest, or its equivalent, when made to rotate."

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Gums and Resins of Commerce.** By P. L. Simmonds.

(Continued from page 127.)

Mezquite Gum.—Attention has recently been called in the United States to the discovery, in great abundance, of a species of acacia, known as the mezquite tree, which furnishes large quantities of gum, nearly equal to the gum arabic of Africa. It will no doubt prove a valuable source of revenue to the State of Texas, New Mexico, and the adjacent Indian territory, besides affording employment to the different tribes of Indians, now roving upon the plains, many of whom would be glad to gather and deliver it to the different frontier government posts for a very small compensation.

The mezquite is by far the most abundant tree of the plains, covering thousands of miles of the surface, and always flourishes most luxuriantly in elevated and dry regions. The gum exudes spontaneously in a semi-fluid state from the bark of the trunk and branches, and soon hardens by exposure to the atmosphere, forming more or less rounded and variously-colored masses, weighing each from a few grains to several ounces. These soon bleach and whiten upon exposure to the light of the sun, finally becoming nearly colorless, semi-transparent, and often filled with minute fissures. Specimens collected from the trunks of the trees, were generally found to be less pure and more highly colored than when obtained from the branches.

The gum may be collected during the months of July, August, and September; but the most favorable period for that purpose is in the latter part of August, when it may be obtained in the greatest abundance, and with but little trouble. The quantity yielded by each tree varies from an ounce to three pounds; but incisions in the bark not only greatly facilititate the exudation, but cause the tree to yield a much greater amount. As it is, a good hand will probably be able to collect from ten to twenty pounds in a day. Were incisions resorted to, double the amount might be obtained.

A simple, pure gum, was recently shown at Madras, obtained in Travancore, from the *Macaranga indica*, which has been used for taking impressions of leaves, coins, medallions, &c. When the gum is pure and carefully prepared, the transparent impressions are as sharp as those of sulphur, without its brittleness. The exudation appears to be an entirely unknown production.

Keekur gum, a variety of Arabic, is produced by *Vachillia farnesiana.*

*From the Journal of the Society of Arts, Lond. November, 1855.

Acacia Sirissa in India yields a large quantity of a clear gum known as Dirisani gum, and closely resembling Keekur gum. Booraga, obtained from *Bombax malabricum*, is a pure gum.

Tragacanth is a gummy exudation, obtained from various species of *Astragulus; A. verus* (Olivier), *gummifera creticus* (Lamarck), which is imported for medicinal purposes from Smyrna and other ports in the Levant, to the extent of about five or six tons per annum. It is obtained principally from Northern Persia, Asia Minor, and America. Hamilton (Researches in Asia Minor, &c.) states that tragacanth, which is called by the Turks "kittereh," is collected in large quantities in the hills about Buldur, from a low prickly plant, resembling a species of furze. The white flaky gum is obtained by making an incision in the stems near the root, and cutting through the pith, when the sap exudes in a day or two and hardens in the opening, after which it is collected by the peasants. Its price there was about 3*s*. 2*d*. per lb.; 23 tons were imported in 1850 from Smyrna, and the imports have since annually increased, until in 1853 they reached nearly 70 tons.

A spurious tragacanth is obtained in the East from the *Sterculia urens* and *S. fœtida*, and an inferior tragacanth is also procured from *Cochlospermum gossypium*.

Leaving the true gums, we come now to the Resins. These are either natural exudations or are obtained from some vegetable compounds by the aid of alcohol, in which they are generally soluble, although totally insoluble in water. They are for the most part brittle, tasteless or insipid, fusible at a moderate heat, soluble in the fixed and volatile oils, and some in the muriatic and acetic acids. They have no smell, except when they retain a portion of volatile oil, in which case they partake of the smell and acid taste of that oil. Resins generally burn with a strong yellow flame, emitting at the same time a vast quantity of smoke. Dammer affords a good example of the resins.

It is strange that of the origin of substances at once so valuable and so familiar to us so little should be known. The sources of the dammer and many of the wood oils from Singapore and the Eastern Archipelago are little known, nor are the copals, the anime, the myrrhs, and other valuable gums and resins from Africa, Zanzibar, &c., well defined.

Colophony, the ordinary resin of commerce is the residuum remaining in the body of the still after common turpentine has been submitted to distillation for the manufacture of the oil of turpentine of commerce, or spirit of turpentine. The black resin, or colophony is the cooled brittle mass in the state in which it leaves the still; the amber or yellow-colored, is the same resin mixed with about one-eighth part of water while it is yet fluid.

Large quantities of resin oil, or pine oil, as it is generally called, are made in the metropolis and in the neighborhood of Liverpool, Hull, Bristol, and Glasgow, and it is employed in the manufacture of grease for lubricating the bearings of heavy machinery, and the axles of railway wagons, &c. It is much used in France for the manufacture of printing ink, and hence a principal source of the unpleasant odor of some of the French newspapers. About 23,000 tons of rosin are annually imported,

of which the bulk comes from America, and a little from the Hanse Towns.

One of the most important oleo-resins in a commercial point of view is turpentine, of which we import from 17,000 to 25,000 tons per annum, almost exclusively from the United States. The comparative receipts in the last nine years have been as follows:—

	Tons.		Tons.
1846, .	17,897	1851, .	21,790
1847, .	16,193	1852, .	24,080
1848, .	20,089	1853, .	19,650
1849, .	20,666	1854, .	17,038
1850, .	21,731		

In the State of North Carolina, about 800,000 to 1,000,000 barrels of turpentine are now annually made, giving occupation to about 5000 laborers in making it, and perhaps three time as many more human beings are supported mainly from the proceeds of its first sale. There are about 200 stills in operation there. The income of North Carolina from her pineries alone must reach half-a-million sterling.

The multifarious uses of the pine tree seem to augment with the development of the inventive talent and ingenuity of the age. Manufacturers already extensively use it in various processes. The painter draws deeply upon the turpentine to paint the four million of dwelling houses in Great Britain, and the same number in the United States, besides the carriages and other vehicles. That great lever of public opinion, the press, could not put forth a printed page without it. Turpentine to the value of £50,000 or £60,000 is annually consumed in America by the India rubber manufacturers. The new process of lighting up houses and whole cities with rosin-gas in America is consuming every barrel made, and has greatly raised its price there. The soap-maker, too, has long used it, and could not now dispense with it.

A liquid resinous exudation known as Chiam or Cyprus turpentine is obtained from Syria and the Greek Archipelago from *Pistacia Terebinthus*. The trunks of the largest trees are cut across with a hatchet and the turpentine runs down on flat stones placed for the purpose, where it hardens. The quantity obtained from each tree is only about eight or ten ounces.

The coniferous trees of Europe and America furnish the turpentine, tar, and pitch of commerce, especially in Europe, *Pinus Sylvestris*, and *P. Pinaster*.

The swamp or long-leaved pine supplies the chief portion of the turpentine, tar, &c., consumed in or exported from the United States. *P. Tæda*, abundant in Virginia, yields common turpentine, but of a less fluid quality than that which flows from the preceding species.

The resins are chiefly used in making varnishes and lacquers, for several purposes in dyeing, for sealing wax, and for ornamental house papering.

Varnishes may be divided into three classes, spirit varnishes, volatile oil varnishes, and fixed oil varnishes. The first class are easily prepared and applied, dry quickly and are free from unpleasant smell; they are used for articles of furniture and musical instruments.

The resins which enter into their composition are seedlac, benzoin, anime, or thus. The varnishes made with essential or volatile oils are chiefly used for pictures—caoutchouc, and oil of turpentine, (turps, as it is familarly termed,) enter into their composition. Fixed oil or fat varnishes—dry easily—at common temperatures, and form a solid and nearly colorless glazing suited for coach panneling and house painting.

The fine copal varnishes do not dry so readily as if mixed in the proportion of three parts of anime and one of copal. Oil varnishes require to be kept a considerable time to ripen, as it is technically termed, before they are fit for use, the time varying from three to twelve months, according to the purpose for which they are intended, in order that the driers and other feculencies may be deposited and the varnish become bright and transparent.

Varnishes are very extensively employed in the arts and for domestic purposes. When we consider the large number of vehicles in use of various kinds, the superior classes of which, as private coaches, omnibuses and cabs, railway carriages, and the paint-work of ships' cabins, houses, and household furniture, pictures, &c., all require varnish, we shall be able to form some slight idea of the consumption. The tenders for one railway company alone, the London and North Western, are for 1500 gallons at a time. Gold and bronze lackering, and varnish for stoves, &c., are other uses. The recent permission to use methylated spirit in the manufacture of varnish, free of duty, bringing down the price some 10*s.* to 12*s.* a gallon, will give even a further stimulus to the demand for resins, and probably lead to the more general employment of varnishes for wood-wook instead of paint.

According to Thunberg, the very best Japan varnish is prepared from *Rhus vernifera*, which grows in great abundance in many parts of that country, and is likewise cultivated in many places on account of the great advantages derived from it. This varnish, which oozes out of the tree on being wounded, is procured from stems that are three years old, and is received in some proper vessel. At first it is of a lightish color, and of the consistence of cream, but grows thicker and black on being exposed to the air. It is so transparent when laid pure and unmixed upon boxes or furniture, that every vein of the wood may be seen. For the most part a dark ground is spread underneath it, which causes it to reflect like a mirror, and for this purpose recourse is frequently had to the fine sludge, which is got in the trough under a grindstone, or to ground charcoal; occasionally a red substance is mixed with the varnish, and sometimes gold leaf, ground very fine. This varnish hardens very much, but will not endure any blows, cracking and flying almost like glass, though it can stand boiling water without any damage. With these the Japanese varnish the post of their doors, and most articles of furniture which are made of wood. It far exceeds the Chinese and Siamese varnish, and the best is collected about the town of Jesino. It is cleared from impurities by wringing it through very fine paper; then about a hundredth part of an oil called *toi*, which is expressed from the fruit of *Bignonia tomentosa*, is added to it, and being put into wooden vessels, either alone or mixed with native cinnabar, or some black sub-

stance, it is sold all over Japan. The expressed oil of the seeds serves for candles. The tree is said to be equally poisonous with the *rhus vernix* or American poison tree commonly called swamp sumach.

The varnish tree of the Burmese (*Melanorrhœa usitatissima*) is spread over a wide range of country, extending from Memipur, in lat. 25 N. long. 94 E., to Tavoy, lat. 14 N., long. 97 E. It attains its greatest size in the valley of Kubba, distance about 200 miles from the sea-shore. The trees average from 30 to 40 feet high, and have a circumference of from five to eleven feet, four feet above the ground. A good tree yields about 10 or 12 lbs. of varnish annually, and its value at Prome, on the Irawaddy, is about 10*d*. the pound; it is used in enormous quantities by the natives as a lacquer.

Dr. Wallich states that the natives never experience those deleterious effects from handling the varnish in its liquid state, which Europeans generally suffer; in its fresh state, it has very little pungency of taste, and is altogether devoid of smell. The natives are very apt to adulterate that brought to market with sesamum oil.

Wood Oils.—This class of resinous oils, known in all the Indian bazaars as gurgun oils, is obtained by tapping certain trees of the order Dipterocarpeœ (*D. lævis*, Hamilton; and *D. turbinatus*, of Roxburgh), and applying heat to the incision. The tree is a native of Chittagong, Pegu, Assam, the valley of Kubba, and the jungles of the Malayan peninsula, and grows to a great height. It is described as having a straight stem, of more than forty feet to the first branch. When not tapped too soon, the base of the trunk is often of immense girth, having a circumference of thirteen feet and upwards. About the end of the dry season, that is, in March and April, several deep incisions are made with an axe into the heart of the wood, and a good sized piece scooped out; into these holes fire is placed, and kept burning until the oil begins to run, when it is received into a bamboo, and allowed to ooze slowly drop by drop. The average produce is about 40 gallons in each season. The oil which flows from the wound is a mixture of balsam and volatile oil, and when applied as a varnish to wood or other substance, the oil evaporating deposits a hard and durable coat of resin.

These wood oils are chiefly used as natural varnishes, either alone or in combination with colored pigments; also as a substitute for tar in paying the seams of shipping, and for preserving timber from the attacks of white ants. They are said also to be useful as an ingredient in lithographic inks. This oil has all the medical properties of some of the more esteemed balsams.

From the comparatively imperfect knowledge we possess of the trees from which these valuable substances are derived, the oils generally receive the names of the localities from which they are imported—hence there are wood oils from Canara, and the Madras Presidency, Malacca, Pegu, Moulmein, and Rangoon, Singapore, Tinnevelly and China. The last named deserves notice, as being one of the substances of which the well known and much prized Chinese lacquer is made. It is used in Singapore for painting the beams and wood-work of native houses, and may also be mixed with paint when not exposed to the sun.

Dammer is the eastern name for a kind of indurated pitch or turpentine

exuding spontaneously from various trees indigenous to most of the Indian islands. The principal species are *Dammara Australis* (Don), the Kauri tree of New Zealand, and *D. Orientalis*, the pitch tree of Amboyna. The trees yield the dammer in amazing quantity, and generally without the necessity of making incisions. It exudes through the bark, and is either found adhering to the trunk or branches in large lumps, or in masses on the ground under the trees. As these often grow near the sea-side, or on the banks of rivers, the dammer is frequently floated away, and collected in distant places as drift. It is exported in large quantities to Bengal and China, and is used for all the purposes to which we apply pitch, but principally in paying the bottoms of ships. About 200,000 bundles of dammer are annually exported from Siam. Dammer fetches from 26*s.* to 32*s.* per cwt. in the London market. 100 to 300 cwt. of dammer and resin are annually exported from Ceylon.

The fruit of *Diospyros Embryopteris*, a native of the East, is so glutinous as to be used in Bengal for paying boats. A cheap and ready substitute for tar for preserving cordage, &c., might easily be found in some of the numerous resins and gum elastics of India.

Copal is a valuable and singular kind of resin, that, according to some authorities, naturally exudes from different large trees found in the East Indies. Dr. Ruschenburger (*Voyage Round the World*) still asserts that it is a gum found about the roots, whence it is dug up in large quantities, and is often obtained from places where the tree had been grown many years before. The best copal is of a bright yellow color, as transparent as amber, in small rounded lumps or flat pieces, hard and brittle, but easily reduced to powder. Its specific gravity is about 1·100. When dissolved in linseed oil, it forms a beautiful varnish, which, when applied to pictures, snuff-boxes, tea-trays, &c., gives lustre to the painting and brings out the colors. Copal is liable to be confounded with gum anime, which exudes from the roots of the locust tree (*Hymenæa Courbaril*).

According to M. Landerer, of Athens, there are three varieties of copal, differing from each other in their properties, viz., Brazilian, West Indian, and East Indian or Levantine, copal. The latter variety is sold in the bazaars of Jerusalem, Mecca, and other places as a species of choice incense, and it plays a very leading part in all the fumigating drugs of the East. The people employed in the collection of the copal in Palestine and Abyssinia dig deep trenches round the tree, and then collect and sort the pieces of gum which fall into them. They are afterwards freed as much as possible of the earth that adheres to them by washing and stirring. African copal is obtained from a species of *Hymenæa*, and from fourteen to seventeen tons are imported to Liverpool from Sierra Leone. New Zealand copal is the Kauri gum; Brazilian copal is the produce of *Trachylobium Martianum*. The imports of gum copal, which in 1846, were 759 tons, dropped in 1849, to 200 tons. From the Phillippines we imported 354 cwt. of copal in 1851; 338 cwt. in 1852; and 497 cwt. in 1853; and from Singapore the exports have lately been increasing. In 1849 we received from that entrepot 53 cwt.; in 1850, 40 cwt.; in 1852, 218 cwt.; and in 1853, 521 cwt. The trade reports also record the import of 832 cwt. of copal from New Zealand in

1852, and from those islands 3217 cwt. of gum, not enumerated, were received here in 1853. In commerce, copal is distinguished into the hard and soft kinds. The chief varieties of the former are—First, copal from Madagascar (in large flat yellow pieces), which, when cold, is tasteless and odorless, but when heated, diffuses an aromatic odor: this kind is rather rare. Secondly, the East India copal, the most common commercial variety; it is rough on the surface, bearing the impression of sand. The best specimens are colorless, and in small pieces, constituting the copal from Calcutta. A third, but very small variety, is brought from the Brazils and south of Africa. We receive all the copal proper of commerce from India, whatever its primary source may be. In the Calcutta variety pieces of all the others are to be found; nor is a distinction readily to be made between the white copal of Calcutta, and the yellow resin of Bombay; the difference appears to depend only on the care bestowed on the selection and purification of the pieces. The various resins, from anime to soft copal, Indian and Madagascar, seem to form a continued series, differing only in the increased quantity of oxygen they contain. A curious variety of copal is that in the pebble form, rounded by the action of the water, of which there are specimens on the table.

Copal is the Mexican generic name for all resins. In the collection of products from Mexico shown at Paris, there were several resinous gums, of which no particulars, however, were obtainable—one, an unnamed resin, very much like anime; another termed Axin resin, which burns with little flame and blackens, having evidently much gum with it—a whiter kind, called Archipan resin, has much the same properties, and a bitter flavor. A nominal copal from the same quarter, resembles very closely the resin of Tacamahaca, being of a white color, with a coniferous smell.

Gum Anime of commerce is a resin of great value to the varnish maker, but is now largely replaced by copal. Much of the anime received is believed to be the produce of the locust tree, *Hymenæa Courbaril*, and is, therefore, Western Anime, the Courbaril resin of Demerara. It is obtained there by digging in the vicinity of the roots of the tree, from which it exudes in a vertical direction in columns or pieces, upwards of a foot in length. It may also be obtained by tapping the tree, when in the course of a few days a large solid mass is formed. It may be obtained in great abundance in various parts of British Guiana.

The best anime is, however, obtained from Zanzibar, and some other parts of Africa, whence it is imported in mats, and the fine and medium in cases. The imports are not large of gum anime. In some years it has reached thirty tons, in others it has not exceeded five or six. We now receive about 280 tons.

(To be Continued.)

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*On Basaltic Glass.** By C. Stickel.

The author recommends the employment of basalt in the manufacture of glass. The applicability of basalt to this purpose has long been known

* From the Lond. Chem. Gaz., No. 325.

in the glass-houses, but the author gives some determinate proportions by which glasses of certain properties may be obtained:—

		drms.
1.	Powdered basalt,	10
	" white glass,	10
	Soda,	25
	Ashes,	5

A very dark, brittle, ugly glass.

		drms.	grs.
2.	Basalt,	10	0
	Minium,	5	0
	Potashes,	4	0
	White Arsenic,	0	5

Useless.

		drms.	grs.
3.	Basalt,	10	0
	Quicklime,	1	12
	Potashes,	2	48
	Boracic acid,	0	10

A nearly black, ugly, and very heavy glass, adapted for the decoration of monuments, stoves, &c.

		drms.	grs.
4.	Glass No. 1,	5	0
	Peroxide of manganese,	0	12

After strong fusion it forms fine, dark brownish-red, hard, glassy fragments, like Delft or Wedgewood's ware. It is adapted for plates, syrup-vessels, &c.

		drms.	grs.
5.	Basalt,	5	0
	Broken glass,	10	0
	Soda,	10	0
	Ashes,	5	0
	Peroxide of manganese,	0	5

A beautiful light bottle-green glass, which is readily drawn into threads when fused. This was the most successful of all the experiments.—*Archiv der Pharm.*, lxxxv. p. 19.

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*On the Existence of Multiple Proportion in the quantities of heat, or equivalent alteration of internal space of bodies, caused by definite changes of state as produced by Chemical Combination or otherwise.** By Thomas Woods, M. D.

Gay Lussac having shown that the combining proportions of gases and vapors are either equal in volume or some multiple of each other, and other chemists, particularly Playfair and Joule, having extended the same law to solids and liquids, it is evident that *specific volume* of its combining equivalent is characteristic of matter. But as every substance is composed of matter and space, or of particles with some distance between them, as is shown by expansion and contraction, whenever volume is altered there must be either an addition to or subtraction from the internal space of the body. This alteration of volume is evident in the case of bodies

* From the Lond. Chem. Gaz., No. 322.

expanding or contracting by gain or loss of heat; but in chemical combination, where alteration of internal space must take place also (as shown by change of temperature, and because *specific* volume being characteristic of matter, this volume must change when the matter changes, by a substitution of a mixture of two kinds of matter for one), in chemical combination, I say, this alteration of internal space is not so plainly demonstrable. Still, in the change of temperature, we have not only an evidence, but a measure of the change of state of combining bodies. For, the phenomena of heat being produced by a *dual* force acting equally in opposite directions, one body cooling or contracting as another becomes heated or expands, it may be taken for granted that whenever heat or expansion is found in one body, the opposite change is occurring in some other. Now, regarding this proposition as true, it is intended to be proved from the combinations of oxygen that the internal space of a substance is lost and gained in multiple proportion, in the definite changes of state of bodies, such as in the condensation of vapors into liquids, and liquids into solids, and the reverse; and also in chemical combinations and decompositions; and therefore that the *space* as well as the *matter* of which volume is composed can be only added to, or taken away, in what is called its combining equivalent.

In order to find whether the heat of chemical combination, which is taken as equivalent to the alteration of internal space, is equally produced by the same substance uniting with others, or if not, if it is given out in multiple proportion, oxygen is made to combine with several other simple bodies, and the alteration of temperature noted.

The method of oxidizing these substances, the details of each process being given in the paper, consisting in dissolving them in some suitable menstruum,—for instance, in sulphuric acid, liquor of potash, and nitric acid. When the two former are used, water is decomposed to oxidize the dissolved body; in the last case, the nitric acid is resolved into oxygen and binoxide of nitrogen, the former of which unites with the substance to be oxidized, the latter escaping. Other combinations and decompositions at the same time take place (as detailed in the paper), and being taken into account (decompositions absorbing as much heat as is produced by the combination of the constituents), the alteration of temperature by the oxidation alone is arrived at.

In this manner eighteen different metals were oxidized, but the heat of oxidation was obtained satisfactorily only with twelve. Other experimenters (Favre, and Silbermann, and Andrews,) have, with a different object in view, found the heat of oxidation of fourteen other substances; their conclusions are added as being from unprejudiced sources, and the result of all the experiments is brought together in a table, in order to see whether the law of multiple proportion exists. The numbers found by the different experimenters are all calculated to the same standard. The unit of heat is the amount necessary to raise the temperature of 1000 grains of water 1° Fahr., and the quantity of the metal oxidized is an equivalent of each, oxygen = 1.

To find whether the law extends to change of state when no chemical combination takes place, the amount of heat given out by the condensation of an equivalent of steam, and by the solidification of an equiva-

lent of water, is given. The following is the table giving the thermal equivalents of the several substances, the names of the experimenters, and the ratio of proportion. It is to be remarked, that the condensation of steam being in multiple proportion with the other thermal equivalents, the expansion of all other bodies into vapor must be included; for I showed in the *Philosophical Magazine* for January, 1852, (page 48,) that all bodies expand into vapor in some multiple of their atomic volumes, and their atomic volumes being in ratio also, their expansion or gain of internal space in this definite change must be in multiple proportion.

TABLE *showing the quantity of heat produced in* 1000 *grs. of water by the oxidation of an equivalent of each substance,* O=1.

Name of substance oxidized.	Units of heat.	Ratio.	Name of Experimenter.
Latent heat of ice,	·1603	·1603	
" " steam,	1·287	8 times ·1603	
Iodine,	·8	5 " "	Woods.
Chlorine,	−1·6	twice ·8	Favre and Silbermann.
Nitrogen,	1·6		Woods.
Silver,	1·6		"
Selenium,	2·7	3 times ·8	Favre and Silbermann.
Mercury,	2·4		Woods.
Palladium,	2·42		"
Molybdenum,	3·38	4 " ·8	"
Carbon,	3·3		Favre and Silbermann.
Arsenic,	4·8	6 " ·8	" "
Antimony,	4·8		Woods.
Copper,	4·9		Favre and Silbermann.
Cobalt,	4·8		Woods.
Bismuth,	4·82		"
Nickel,	6·5	8 " ·8	"
Lead,	6·2		Favre and Silbermann.
Hydrogen,	7·8		" "
Tin,	8·0		Mean of Andrews and Favre and Silbermann.
Phosphorus,	8·1	10 " ·8	Favre and Silbermann.
Cadmium,	8·18		Woods.
Iron,	7·95		Mean of Andrews and Favre and Silbermann.
Zinc,	9·6	12 " ·8	Favre and Silbermann.
Manganese,	10·4	13 " ·8	Woods.
Barium,	12·8	16 " ·8	"
Aluminium,	16·16	20 " ·8	"
Sodium,	17·5	22 " ·8	Favre and Silbermann.
Potassium,	17·3		" "

Note.—I proved in a paper published in the *Philosophical Magazine* for October, 1851, that "the decomposition of a compound body absorbs as much heat as the combination of the elements originally produced." I believe I was the first to prove this as a general proposition, and, by so doing, laid the foundation of almost all the thermo-chemical researches since carried on; for, as far as I am aware, no process which took decomposition into account was used before my paper was published.

In a paper read to the British Association at Belfast, and published in the *Philosophical Magazine* for November, 1852, I proved that the intensity of chemical affinity might be measured by the quantity of heat produced by the combination.

As regards the first of these papers, Mr. Joule published in the *Philosophical Magazine* for June, 1852, a memoir proving exactly the same proposition, but giving me the merit of priority in a preliminary remark. It is, however, singular that Favre and Silbermann bring forward in 1853 (*Annales de Chimie et Physique*, vol. xxxvii., p. 507), the very same experiments to prove the same fact, and give it as their own.

As regards the second paper. In six months after its publication, Messrs. Favre and Silbermann (*Annales de Chimie et Physique*, vol. xxxvii. p. 484,) prove the same truth with the same experiments, using exactly the same metals, and give their memoir as producing an original idea.

I notice these coincidences here as being remarkable, and because the propositions contained in the paper referred to are the ground-work of the present experiments, and also with a view to prevent an unconscious repetition on the part of Messrs. Favre and Silbermann.

For the Journal of the Franklin Institute.

Table of Specific Gravity of Sea Water. By W. H. Pile, M. D., Manufacturer of Hydrometers, and Specific Gravity Apparatus.

Messrs. Editors:—If you think the following observations worthy of insertion, they are at your disposal. Having been requested to graduate a number of salinometers, or hydrometers, such as are used on sea steamers to test the density of the salt water of the boilers, I endeavored to find some table giving the specific gravity of sea water containing different proportions of saline ingredients. Being unable to meet with such a table, I obtained an instrument made in New York, in order to ascertain by direct experiment the specific gravity of the various degrees marked on its scale. A very slight observation was sufficient to convince me, that *that particular scale at least* was quite unfit to give correct results; however, by comparing it with an instrument made in Glasgow, and used on board the steamer "*City of Baltimore*," (and which was marked on the scale, "No. of oz. of salt per gallon,") I find the scale is intended to indicate not the number of oz. per gallon, but the proportion of salt or saline ingredients in a quart or 32 ozs. of water. Thus, 1 oz. of salt in a quart of water is marked $\frac{1}{32}$, 2 ozs. in a quart of water $\frac{2}{32}$, &c.

It now became comparatively easy, by making solutions of dry salt in water of these various proportions, to ascertain their actual specific gravity. This I have done with care, both by delicate hydrometers showing specific gravity, and also by the specific gravity bottle.

I may here remark, that as the salinometers is intended to be used at the temperature of 200° Fah., my experiments were made accordingly at that temperature. In the table annexed, I have also given the specific gravity of the different solutions at the temperature of 60° Fah., by means of which the correctness of the salinometer may be verified with

much less trouble. As the specific gravity of the various saline substances in sea water is very nearly the same as that of salt itself, the results will not differ sensibly, whether we consider the scale of the salinometer as indicating the proportion of all the salts contained in sea water, or as showing that of pure salt only, in a solution of that substance in pure water.

Table of Specific Gravity of Dry Salt (Chloride of Sodium,) in thirty-second parts, dissolved in pure water, at 60° and 200° Fahr.

Scale of Salinometer.	Specific Gravity at 60° F.	Specific Gravity at 200° F.
0	1·000	0·965
$\frac{1}{32}$	1·022	0·987
$\frac{2}{32}$	1·043	1·009
$\frac{3}{32}$	1·063	1·029
$\frac{4}{32}$	1·082	1·049
$\frac{5}{32}$	1·100	1·067
$\frac{6}{32}$	1·116	1·083

It is usual to mark the limit of density on the scale of the salinometer at $\frac{3}{32}$. Engineers, however, are not confined to this point, some blowing off sooner than others.

Corner of Passyunk Road and Catherine St., Phila.

For the Journal of the Franklin Institute.

The U. S. Steamer Niagara.

In the July number of the *Journal*, I gave my impressions of this war Steamer, and regretted that for her vast size externally, she was so deficient in accommodation and armament within. My remarks were made with the best feeling for all concerned in her construction, and while I acknowledged her beauty of outline, speed, &c., I also mentioned what I considered defects arising from a want of experience in that particular branch of ship building.

My remarks have attracted the attention of the *Editors of the Nautical Magazine*, not from any merit they possess, but from the position they occupy in this *Journal*, a courtesy for which I should thank them, and I will endeavor to make myself more fully understood. The *Niagara* is longer and wider than the other five steamers, and when complete will have about the same draft of water. She will then represent 4750 tons measurement, 12 11-inch guns, and 23 feet of draft of water. While each of the others will represent 3500 tons measurement, 40 guns from 10 down to 8-inch bore, and 23 feet draft of water. In a naval engagement, the armament of the latter ships is every way superior to that of the *Niagara*, while the former would have the advantage in attacking a fortification, as her guns are of larger bore, and have a longer

range, but any one who has visited the other steamers will at once have seen that they could easily carry the *Niagara's* armament on their spar deck, without touching the gun deck battery of 8-inch guns. The Ordnance Bureau have armed these ships differently, for reasons which I have no doubt are satisfactory.

To say that it requires a ship of 4750 tons, drawing 23 feet of water, to carry 12 11-inch guns is absurd, and the *Editors of the Nautical Journal* have since the issue of their first number, written pages on this very subject, viz: the importance of having moderate sized *light draft* vessels carrying heavy guns. And I have no doubt but the Senior Editor of that *Journal* could, without difficulty, design a vessel of 2375 tons that shall carry the same armament, and not exceed 18 feet draft of water. They state that Mr. Steers was required to adapt his model to a certain amount of power; this is incorrect; his model and plans were made before the Board of Engineers met at Washington; he informed them that he could spare 100 feet in length of his vessel by the whole width, and they acting on this information, gave her 50 per cent. more power than the other ships, intending for her bunks to hold 900 tons of coal. Since the ship has been launched, this space of 100 feet has been encroached upon to make room for other stores, and my original statement that she was externally large, and internally small, is true. She might and should have had 3, instead of 2 decks. In my former article I stated that before a person could properly design a naval vessel, he must first *know* what they required. To this remark, the *Editors of the Nautical Journal* object, and they assert that private constructors ought, and do know best what models are most appropriate for naval purposes. I consider it no discredit to the private constructors of the country to say that I do not believe that there is one of them sufficiently acquainted with naval affairs to say how many square feet of deck room, how many cubic feet of capacity, or how many tons of displacement are required for a given armament (the armament regulating the crew, the crew the stores, &c.) The old maxim, that *experience teaches all things*, is as true here as elsewhere, and the *Editors of the Nautical Magazine* would themselves find if they ever make the trial, that they have something to learn even on that subject. A word in conclusion; the constructors of the Navy are gentlemen regularly brought up to their business, and as such, are entitled to the respect of those in the profession. To charge that everything done under their superintendence is badly done, that their models are bad, their workmanship defective, and by implication that they know nothing about their business, is not, in my opinion, a proper construction of the golden rule; and while it may answer for a *Naval Journal*, it will not, I trust, find many followers. FULTON.

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*New Volumetric Determination of Chlorine in its Combinations.**

By Dr. MOHR.

Levol has described a means of determining chlorine by a solution of silver, in which he renders the completion of the precipitation per-

* From the Lond. Chem. Gaz., No. 325.

ceptible by an addition of phosphate of soda, the presence of an excess of silver being indicated by the yellow tint of the precipitate. The author has found that by this means the results are always too high, in consequence of the very slight color of the phosphate of silver, which requires to be present in considerable quantity to become visible in the precipitate of chloride of silver.

The author accordingly tried arseniate of soda, and obtained much better results, from the brownish-red color of the arseniate of silver, but soon passed from this to chromate of potash, which afforded results beyond his expectations.

When phosphate, arseniate, carbonate, or chromate of silver is mixed with solution of chloride of sodium, there is an instantaneous formation of chloride of silver and of another soluble salt. At the same time the color of the insoluble silver-salt disappears; and the higher this is colored the smaller is the quantity of it that may be recognised, and the more perceptible is the transition to the colorless or light yellow condition. But if a drop of silver solution be present above the quantity of the metallic chloride, the blood-red color of chromate of silver makes its appearance distinctly. If 0·2 cub. centim. too much of the silver solution be added, the mixture is more than distinctly red. If chromate of potash were colorless, the phenomenon would be still more striking. But even in this case the formation of chromate of silver is perceived with a single drop of normal silver solution. The solution must not be acid, as then chromate of silver is not formed, or only in very small quantities, and besides bi-chromate of potash has a rather red color. A slight excess of pure carbonate of potash, on the contrary, is not injurious, because then only the pale yellow color of chromate of potash can be exhibited. Much carbonate of silver is disadvantageous, as carbonate of silver has no striking color, although it is decomposed by metallic chlorides.

Two burettes filled with normal solutions are placed close together; an undetermined quantity of fluid is allowed to run from the burette with chloride of sodium, and the red color is then produced by the addition of silver solution. The two burettes are then read off. A few cubic centimetres of a solution of neutral chromate of potash were added. The following numbers were obtained:—

Solution of chloride of sodium.	Solution of silver.
4·2 cub. centims.	4·3 cub. centims.
6·7 "	6·8 "
11·0 "	11·1 "
12·0 "	12·1 "
17·65 "	17·75 "
18·2 "	18·3 "
25·85 "	25·95 "
26·0 "	26·1 "

Thus in every case an additional $\frac{1}{10}$ cub. centim. of silver solution was employed, and this was exactly the quantity above that necessary for precipitation, but required to indicate its completion. When solution of chloride of sodium is dropped in until the disappearance of the reddish color, both burettes stand exactly even.

The author then employed this method with weighed portions of metallic chlorides, and obtained the following numbers:—

0·2 grm. of chemically pure and perfectly dry chloride of sodium = 34·4 cub. centims. of silver solution; on the other hand, 0·1 cub. centim. of chloride of sodium = 34·3 cub. centims. of silver solution = 0·20051 grm. of chloride of sodium.

0·2 grm. chloride of potassium = 1. 26·8 cub. centims. silver solution
2. 26·8 " "
= 0·19985 grm. of chloride of potassium.

0·2 grm. of chloride of ammonium = 1. 37·35 c. c. silver solution.
2. 37·25 " "

This gives,—1. 0·19967 grm. chloride of ammonium.
2. 0·199138 " "

These experiments prove that alkaline chlorides may be determined with great accuracy by this method. The author has also employed it with urine, well-water, mineral waters, saltpetre, pot-ashes, soda, and chlorate of potash, and always obtained concordant results. The amount of chlorine in a mineral spring may be determined at the well itself.

The chlorides of barium, calcium, mercury, &c., are precipitated with carbonate of soda; and if the precipitate be colorless, immediately tested with the silver solution, without filtration.—*Liebig's Annalen*, xcvii. p. 335.

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*The Manufacture of Alloys or Combinations of Metals.**

It is curious, but nevertheless an undeniable fact, that no kind of manufacture has received less benefit from the recent progress of chemical knowledge in this country, than the fabrication of alloys. This is all the more surprising when we consider the enormous field open to inquiry, and the richness of the harvest to be there gathered. A new alloy is really a new metal given to society; and although the apathy of scientific men with respect to the subject has hitherto led to the production of very few such metals, yet more than one example may be cited where a large fortune has followed upon an invention of this kind. So completely, however, has Science closed her eyes to this uncontested arena of profitable improvement, that the very word "alloy," has received no chemical definition in the latest scientific works; and hence we are compelled to begin our present observations by defining its meaning with regard to the past, the present, and its probable future.

The origin of the word, as applied to metallic compounds, is no doubt coeval with the age of the so-called "noble" and "base" metals; a form of language naturally leading to the conclusion, that when any noble metal was mixed with a base one, its nobility was "allayed" or "alloyed" and consequently diminished. In this sense, the base metal came to be regarded as the allay or alloy, and as such is thus described by an old writer:—"Alloy is the proportion of a baser metal mixed with

* From Newton's Lond. Journ., March, 1856.

a finer or purer; as the quantity of copper that is mingled with gold, to make it of a due hardness, is called the alloy;" and with this meaning, the word is still used by our assayers of gold and silver. But it is clear, from the very nature of the example here chosen, that no admixture of one base metal with another like itself, could generate an alloy in the opinion of writers of the old school; nor can we anywhere find that brass, bell-metal, &c., were called alloys, until mixed with gold or silver.

If, however, we now proceed to examine the meaning of the expression alloy, in the present day, we shall find that it extends to every admixture of two or more metals, and is, perhaps, no less absurdly diffuse than it was previously limited. On the new system, 99 parts of gold and 1 of copper is an alloy of gold; whilst 99 of copper and 1 of gold is an alloy of copper: nor is there any fixed or recognised limit, at which an admixture of metals ceases to bear the name of alloy; in fact, almost every metal we now use, might, from its casual impurities, come within the boundaries of this definition. Lead with a trace of silver will thus be an alloy of lead; and iron containing a trace of manganese an alloy of iron. Such a state of things cannot fail in the end to produce uncertainty and confusion; therefore we propose to establish, for present purposes at least, a distinction betwixt what we shall call an alloy of metals and an admixture.

Many years ago Dr. Dalton drew attention to the fact, that many of the alloys in ordinary use, as brass, &c., were very nearly atomic compounds, or in other words, mixtures of metals in such proportions, that one combining equivalent of the one was united with one, two, or three equivalents of the other; and this peculiarity was found to extend to what may be termed native or natural alloys. Thus brass of good quality consists of about 34 zinc and 66 copper in 100 parts, which is very nearly in the proportion of one atom of zinc to two atoms of copper: and again, the native alloy of gold and silver, called "electrum," is said, by Boussingault, to consist of two atoms of gold and one of silver. In fact, many such examples might be pointed out in support of Dalton's opinion, though it is quite certain that in this, as in many other of his assertions, he carried his views too far, and was misled by his mathematical bias. Silver and iron, for example, refuse to unite permanently, and separate on cooling; but the iron retains, in this case, a small and variable quantity of silver, whilst the silver retains a little iron: similarly lead and zinc comport themselves; and in neither instance can any reasonable grounds be found for inferring that an atomic combination has ensued. It would appear, therefore, that the union of some metals in atomic proportion can be effected, whilst with others it cannot; and hence, for the former, we propose to retain the word "alloy,"—using the expression "combination of metals" for the latter. On this basis, therefore, an alloy will mean a mixture of one or more atoms or equivalents of one metal, with one or more atoms or equivalents of another, so as to form what may be called a chemical compound; whereas a "combination of metals" will merely imply a mixture in no definite proportions, but suggesting the idea of a mechanical compound; thus brass formed from 34 parts of zinc and 64 parts of copper, or 34 zinc and 96 copper, would be

an alloy,—whilst our ordinary silver and gold coinage would be an admixture of metals.

With this preliminary definition we will now proceed to examine the few alloys in common use in the arts, or, more correctly speaking, those compounds which nearly approach the nature of alloys. In such a list we may place brass, type-metal, bell-metal, speculum-metal, pewter, Britannia-metal, and solder. The first has been already described; the second generally consists of about 5 parts of lead and 1 of antimony, which closely approaches to 3 atoms of lead and 1 of antimony. Bell-metal is composed of 4 parts of copper to 1 of tin, and may be regarded as an alloy of 7 atoms of copper to 1 of tin. Speculum-metal contains about equal quantities of copper and tin, with small and variable proportions of arsenic: it may, consequently, be looked upon as composed of 2 atoms of copper and 1 of tin. Pewter and Britannia-metal are triple compounds of tin, antimony, and lead, in which the proportions approach, for the first, an atom of each ingredient, and for the second, 3 atoms of tin, 2 of antimony, and 1 of lead. Solder is more variable than any of the others; but the best kind is made with 3 parts of lead and 1 of tin, which corresponds to about 2 atoms of lead and 1 of tin. There are other compounds which might, perhaps, have been brought within this group; but as, in reality, none even of those we have selected, are, strictly speaking, alloys in our limited sense of the expression, it is useless to follow the subject further, than to show, by this near approach to atomic combination, how probable it is that the same substances fabricated with a due regard to that proportion, would possess more useful qualities, and less frequently disappoint the expectations of the artizan. Take, for example, the case of bell-metal, an article notorious for the uncertainty of its results: this compound contains, according to the caprice of its fabricator, from 12 to 22 parts of tin, with from 88 to 78 parts of copper, and a little antimony, arsenic, or even iron; if, however, it requires to be an alloy of 7 atoms of copper and 1 of tin, the proper proportions would be 79 copper and 21 tin. With facts of this kind before our eyes, it certainly does seem strange that nothing practical has arisen in this country with respect to alloys; and we cannot help thinking that amongst the other elements of a working man's education, the doctrine of definite combining proportions might very properly be included. It is, in effect, the "golden rule" of practical philosophy, and once learned, can never be forgotten; by its unerring agency the discoverer is led on in a safe and economical path, far removed from the vicissitudes of chance and the errors of experiment. Let us imagine, for instance, that an artizan, after much labor, has ascertained that a certain mixture of two metals will answer the purpose he requires; this man must rest content; or, if he thinks of improvement, it can only be in the hope that accident will one day furnish him with a hint; but, guided by a knowledge that substances have a tendency to form stable and uniform compounds only when they unite in atomic proportions, he would immediately examine the quantities he had found effective; and, if these approached within certain limits, he might easily make a correction, with the full assurance of a successful issue. And wherein resides the difficulty of teaching such men the simple doctrine

in question? There is, in fact, but one difficulty, and that is to provide teachers. In all our systems of education the importance of imparting practical knowledge is much overlooked; and this is especially the case with the lower orders. As, however, it must be at all times more commendable to convert a workman into a philosopher than a philosopher into a workman, we trust the day is not far off in which the head and the hand of the same individual shall be able to work in unison.

Quitting the subject of alloys, the more extended question of metallic combinations presents itself; and inasmuch as that nearly the whole of the metallic articles now manufactured belong to this class, the investigation seems almost endless. When, however, we take a glance at the objects sought to be attained by these combinations, the result becomes much less formidable. With scarcely an exception, this result resolves itself into the two desiderata of increased mechanical strength and diminished destructibility from atmospheric and chemical agency. The latter is within the sphere of hourly observation, and includes the tinning of iron, brass, and copper, the zincing of iron, and the gilding and plating of many other metals, either by electricity or otherwise. The prospect of improvement in this department seems chiefly limited now to the employment of electricity through the intervention of other agents than water,—a medium evidently unfitted for the deposition of a great variety of metals, amongst which platinum, iron, nickel, zinc, chromium, and perhaps aluminium, may be mentioned. The object here will therefore consist in procuring materials of easy fusibility, capable of transmitting the electric current, and holding in solution the oxides or salts of the metals to be operated upon. For this purpose the fact discovered by Berthier may prove useful. It is that "various salts, in atomic proportion, fuse together at a much lower temperature than the more fusible of the two." Thus, an atomic mixture of carbonate of potash and carbonate of soda, fuses readily at a dull red heat. An atom of sulphate of lime, with an atom of fluoride of calcium, is still more remarkable; and innumerable instances of the same kind might be cited. Having thus obtained a suitable solvent, we may dissolve in this, at a red heat, some of the metallic substance which it is desired to coat with; and then, with perhaps a more powerful battery than for water, we may proceed in the usual way. For the sake of illustration, let us suppose that a mixture of nitrate of lead and nitrate of potash, or a mixture of oxide of platinum and caustic potash, has been fused together: the question is, whether, by making the ordinary electrical arrangements, a piece of copper might not be covered with lead or platinum to any required extent or thickness.

But the most important application, by far, of the admixture of metals, is that which refers to increased mechanical strength. On this head there seems to be enormous scope for industrial development. During many years a gross error seems to have been gaining ground, to the effect that purity was an essential condition for strength in metals; but nothing can be further from the truth. The grand characteristic of purity is the power of crystallizing; so that the more pure the metal, the less its cohesive strength; of which an excellent example is afforded by zinc. This metal when quite pure, cannot be rolled into sheets, and requires, therefore, to be mixed with a very small quantity of lead before being

sent to the rollers; the lead diminishes the tendency to crystallize, in the same way that stearic acid is prevented from assuming the crystalline form, by the presence of a minute portion of wax or arsenious acid. The necessity for mixing copper or some other metal with gold and silver is extremely well known; and yet this purity hypothesis, with regard to metals in general, has not only progressed rapidly, but taken deep root in quarters where more knowledge of the truth was to have been expected. Hence we have seen pure iron, pure copper, and pure lead employed, where this very purity has been the chief cause of failure. Not to mention the monster gun of Mr. Nasmyth, with its pure iron, we will relate an instance which had many illustrations to prove it:—On one of our largest railways, a contract had been made with a large manufacturer to supply the purest copper for making the fire-boxes of locomotives. The copper was sent, and the fire-boxes made; but when used were found to wear away with the most astonishing rapidity; so that impurity in the metal was at once suspected. A searching chemical analysis proved, however, that the manufacturer had only too closely complied with the terms of his contract;—the copper was absolutely pure. Again, if we regard the present state of copper sheeting in regard to ships, we see that the pure metal has been quite expelled from use by the "yellow metal," or combination of Mr. Muntz. In short, wherever mechanical strength is of importance, a pure metal is interdicted, and this too even in the case of iron. We are not ignorant that such an assertion will excite the surprise of many, and perhaps elicit the hasty contradiction of a few; but the opinion will bear discussion, and has evidence in its favor. Thus, Berzelius tells us that "le fer contenant du cuivre à plus de ténacité que tout autre;" and a patent has actually been taken out in this country for such a mixture. Again, zinc, in minute quantity, is known to increase the strength of iron; and the same holds good with respect to gold. The best Swedish iron generally contains a little chromium or vanadium, which latter metal was, in fact, first discovered in an iron remarkable for its great strength. Not to burden ourselves, however, with examples, we will proceed at once to disclose the probable action of these mixtures upon the iron. We have seen that in the instance of stearic acid, the disposition to crystallize can be prevented by the addition of a very minute portion of some foreign substances; thus, one part of arsenious acid, will prevent the crystallization of 1000 parts of stearic acid. In the same way the tendency of iron to crystallize may be prevented by intermixture with other metals. And the great question to be solved is,—what metals answer the purpose best? He who studies the book of nature with care will seldom lay it down without profit; and thus instructed, we direct attention to one of the most remarkable combinations of iron known to mankind.

In all the quarters of the world, as if resolved to multiply the lesson, nature has placed certain metallic masses, to which the name "meteoric iron" has been given, on the supposition that these masses have fallen from the atmosphere. Many of them are known to have lain for ages where they now are, but yet they retain their original metallic character, and seem to suffer little or nothing from the oxidizing influences of air and moisture. The composition of this meteoric iron is singularly uni-

form, and whether near the poles or the equator, consists chiefly of iron and nickel; the latter varying from 2 to 10 per cent., with small quantities of cobalt, and (it is said) chromium. The remarkable fact that the first three metals, iron, nickel, and cobalt, are the only ones which obey the magnet, seems to establish a connexion between these masses and the name they bear, which may one day lead to interesting discoveries; but at present we wish to direct attention wholly to their apparent indestructibility, and to the great strength and ductility of the metal which composes them. To close our eyes upon a lesson of this kind is absolute folly; and as science has demonstrated to us the actual composition of meteoric iron, it follows that, if meteoric iron possesses any valuable qualities, we ought, by art, to enjoy those advantages thus providentially placed before us. In other words, the manufacture of meteoric iron ought to become a branch of the national industry. So far as science is concerned, this important question has not been lost sight of;—artificial meteoric iron has been made, and it has been tested, so as to prove that its qualities are identical with those of the native compound; that in short it is more ductile and has more tenacity than pure iron, and is not so liable to rust or oxidize.

A mixture of 98 parts of iron and 2 of nickel has all the peculiarities of the best meteoric iron; and such a mixture was recommended to the notice of the British Government during what we hope may be called *the late war*. It was proposed to that Government to make cannons, &c., from artificial meteoric iron, and some measures were actually begun for the purpose of testing the value of the proposition. It is perhaps superfluous to say, that as usual, official routine, petty jealousy, and ignorance, were stronger than either the iron or the argument, and accordingly nothing was done. Now, however, the question returns to that intelligence which gives life and character to our entire constitution: the fabrication of meteoric iron is before the manufacturing industry of Great Britain—to be accepted, or to be refused.

Hitherto the difficulty of procuring nickel, exempt from arsenic, has offered an insuperable obstacle to success; but now we know that within our own shores an abundant supply of pure nickel exists. Within these few years an ore of sulphuret of nickel, devoid of arsenic, has been found near Inverary, in Scotland, and by its means meteoric iron has been made of the very best quality. This, in fact, formed part of the argument presented to the consideration of our governmental authorities. The mine of this ore exists on the estate of His Grace the Duke of Argyll, and promises to yield an ample amount of ore when fully developed. It is now worked, and as we have before said, the produce may easily be converted into the desired compound, at a merely nominal cost. Specimens of this kind are at present before us, and extensive experiments have shown the practicability of this manufacture. So that we make no doubt of finding, in a very few years, the great lesson so long held up by nature for our guidance, brought home to the hearth of the million, in the demonstrated form of iron instruments which possess increased strength and a greatly diminished tendency to rust and tarnish. Such at least are the advantages offered by the hand of science to this interesting branch of manufactures; and it is not often that science promises in vain.

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements.

By H. Howson, Civ. Eng.

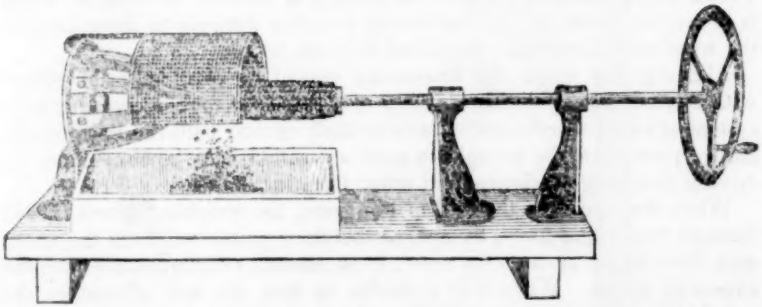
(Continued from page 49.)

Apparatus for Cutting the Kernels from Boiled and Green Corn Cobs, patented by W. B. Coates, May, 1856.

This invention consists in submitting to the action of yielding cutters, arranged in such a manner as to present a circular passage, and having sharp cutting points, cobs of green or boiled corn, by sticking their ends on prongs secured to the ends of a spindle, turning the latter rapidly and causing it to force the adhering cob into the space between the elastic cutters, that the points of the same may so operate on the roots of the kernels, as to cut them off from the husk effectually and rapidly. The apparatus is so arranged that the kernels may be cut from the thinner or thicker portion of the cob alike, and from cobs of various sizes.

Three light iron standards are secured to a plain wooden frame. One of the standards has an orifice of sufficient diameter to allow the largest corn cob to pass through freely, and round this orifice is secured a series of steel cutters, which taper so as to form a circular opening for receiving the thin end of the cob. The two remaining iron standards form the bearings for a light spindle, the outside end of which is furnished with a handled fly wheel, and the opposite end with a series of prongs, to which the thick end of the cob is caused to adhere.

The spindle with its green or boiled corn is turned rapidly by means of the handle, and at the same time pressed lightly towards the yielding cutters, by means of which the kernels are completely stripped from the husk, and drop into a movable box below. The husk passing through the above



mentioned orifice is then removed from the prongs, thrown on one side, the spindle drawn back, and the operation repeated on another cob. To prevent the kernels from flying, the instrument is furnished with a shield of wire gauze or other suitable substance, so hinged to one of the standards as to be raised while the cob is being attached to the prongs of the spindles.

The yielding nature of the cutters allows the smaller as well as the larger portions of the cob, and also cobs of different sizes, to be cleared of their kernels, at the same time they serve as a guide for the cob during the operation.

This contrivance, is intended for the use of hotels, boarding houses, and large families, and is of especial utility to farmers and others, who desire to preserve green corn during the winter months, a practice now very general since air-tight preserve cans have been brought to such perfection.

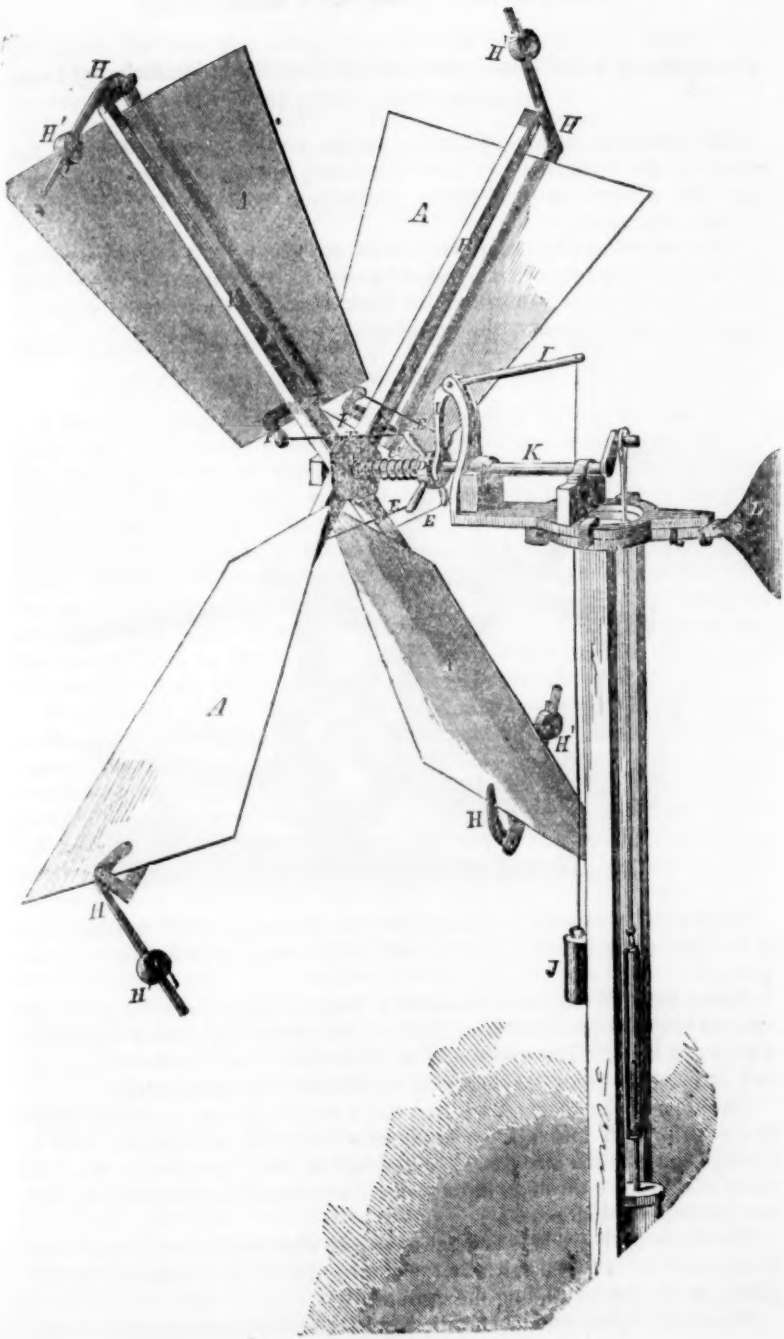
Self-Regulating Wind-mill; patented by A. Lempcke, Pleasant Mount, Wayne County. Pa., March, 1856.

The annexed is a perspective view. A are the wings hinged to the arms B, the latter being permanently secured to a hub attached to the end of the horizontal shaft K, which has its bearings in suitable pillow-blocks secured to a plate, arranged to turn on the top of the upright post of the mill. Bell crank levers H, are pivoted to projections on the ends of the arms B, in such a manner, that the cranked ends of the levers shall bear against the wings on one side of the point where they are hinged to the arms B, the straight arms of the levers being furnished with sliding weights H', which can be readily adjusted to any point by set screws or wedges. D is a nut or collar arranged to slide on the shaft K, and from the edge of this nut project arms corresponding in number to that of the wings A. The ends of these arms are connected by means of rods E, to the ends of the levers F, which are jointed to the arms B, in such a manner that their opposite ends may bear against the wings A, in the same manner as the points of the bell crank levers H. On the shaft K, and between the hub of the arms B, and the face of the sliding nut D, intervenes a spiral spring C. Against the back of the nut bears the cranked arm of the lever I, to the straight arm of which is suspended by means of a cord or chain, the weight J, when the movement of the mill has to be stopped. To the turn plate on the top of the upright is secured the vane L, which is of similar construction, and serves a similar purpose to those used in the wind-mills heretofore described in these papers.

Although the engraving shows the end of the shaft K, as furnished with a crank for operating a pump-rod, it is easy to perceive that by a system of bevel wheels and a vertical shaft central with the upright, the motive power may be brought to such a position as to be convenient for driving threshing machines, and other farm implements.

When the speed of the mill is too great, the weighted levers H, will through centrifugal force, fly out, so that their points will turn the wings with their edges towards the wind, to an amount commensurate with the excess of speed. When it is desirable to stop the mill altogether, the weight J is suspended to a cord on the end of the lever I, so that the cranked portion of the latter forces back the nut D, and with it the spiral spring C, and through the rods E, and levers F, operates the wings so that their edges only are presented to the wind. On removing the weight, the nut D, through the action of the spiral spring recovers its former position, and at the same time the surfaces of the wings are turned to the wind.

The self-regulating apparatus in connexion with Mr. Lempcke's mill is simple and ingenious, and has proved (so the writer has been informed by good authority) most efficient in practical results.


H
H'
H'
H
A
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K
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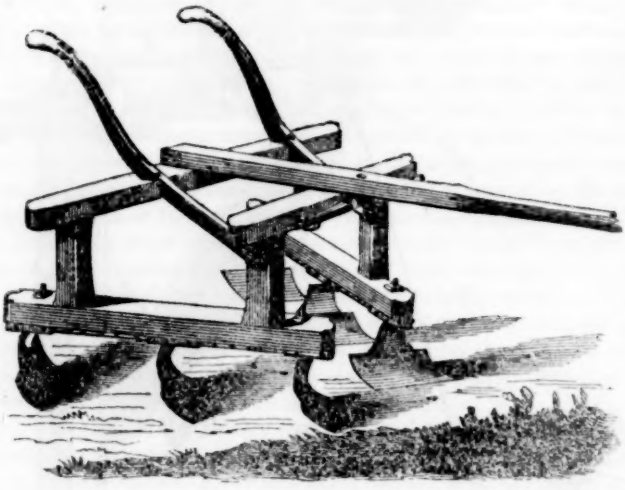
H
H
H
J

Description of a Cultivator; patented by Griffith Lichtenthaler, of Limestonville, Penna., July, 1854.

The peculiar nature of this invention consists in so attaching the shares to the beam that they may be not only readily adjusted in position, but also allowed to yield to any obstruction with which they may be brought in contact.

The apparatus has two lower beams, to which are attached uprights, the latter being connected together by cross-ties. The front end of these beams are nearer together than the back ends, thus giving the usual triangle or harrow-shape to the implement.



To the back cross-tie and front uprights, are secured the handles, and to the two cross-ties the pole by which the machine is drawn over the ground.

Under each of the lower beams is a longitudinal groove for receiving a metal strip, which is secured firmly in the groove by means of suitable wedges or keys. The upper end of each share has a socket formed by two lips, which enter the recess on each side of the metal strip.

The tops of the shares have two holes corresponding to similar holes in the strip, and through the hindermost holes of the lips, as well as through those in the strip, are inserted metal pins, but through the front holes of the lips as well as through their corresponding holes in the strip are inserted wooden pins.

The body of the shares are set nearly at right angles with the lower beams, and the soil is thrown by the shares toward the centre of the machine, as it is moved along the ground.

Should the apparatus meet with any obstruction, such as stones, roots,

or stumps, the front pins being of wood will break and the shares will turn back on the hinder or metal pins as fulcrums. By this arrangement sudden wrenches or breakages of the machine are avoided. Another advantage of the arrangement is the facility of adapting shares of different forms to the machine, according to the nature of the soil on which they are required to operate.

(To be continued.)

On the Causes of the serious Loss of Silver which occasionally takes place during the Roasting of Silver Ores. By Prof. Plattner.

It has been long known from experience, that during the roasting of silver ores and furnace products in a finely divided state, in addition to the mechanical loss of silver through the formation of flue-dust, there also occurs a loss by direct volatilization, varying according to the properties of the ore from 1 to 10 per cent., and in argentiferous blende, exposed for a long time to a strong calcining heat, amounting to much more. These facts give rise to a question which may be divided into two parts, namely,—1st, How does it happen that in ores containing an equal per centage of silver, but of different qualities and composition, the loss per cent. in silver differs when they are subjected to the process of roasting? And, 2dly, In what condition is the silver volatilized?

To solve the first part of this question, many experiments were made on the small scale by the author, in the following manner:—Various substances, for the most part quite free from silver, were reduced to a fine powder, and mixed with other substances rich in silver, and also in fine powder, in such proportion that the mixture should contain from 1 to 2 per cent. of silver; these were then exposed to the action of heat and atmospheric air in capsules of clay. For this purpose a muffle was used heated to dull redness, and most of its openings closed so as to allow of a very moderate circulation of air within it. The heat was gradually raised until it reached the temperature at which sulphate of copper is slowly decomposed. The substances used to mix with those rich in silver were pyrites, blende, various anhydrous metallic sulphates and metallic oxides, and finely powdered quartz; those rich in silver were sulphuret of silver, light and dark Rothgiltigerz (pyrargyrite and proustite), metallic silver, sulphate, arseniate, and antimoniate of silver, all in fine powder.

These substances were roasted from three-quarters of an hour to an hour and a half, and then assayed for silver in the usual way; but in order to ascertain more accurately the amount of silver which should have been obtained from them, an equal amount of the unroasted ore was assayed with equal quantities of lead, so that the slight loss always occurring from the absorption of silver by the cupel ("Kapellenzug,") would be the same in each case; the loss of silver during the roasting was then found by comparing the weight of the two buttons.

* From the Lond. Chem. Gaz., No. 324.

The results of these experiments showed:—

1. That the loss of silver in question was occasioned chiefly by chemical causes.

2. That a volatilization of silver appeared to take place when the silver in the ore either passed from the state of sulphuret into that of metal, or when the oxide of silver, in combination with sulphuric acid, again suffered decomposition.

The loss appeared to be greatest in light, loosely aggregated substances whose particles had little cohesion and were not disposed to sinter together, as they were more readily penetrated and traversed by the atmospheric air.

3. That the loss of silver was greater when the roasting was protracted, if at the same time the temperature was increased.

4. That the loss was increased when magnetic oxide of iron or suboxide of copper exercised a reducing action on sulphate of silver.

5. That generally the loss of silver was greater when the silver existing as sulphate was exposed to a protracted roasting at a high temperature in company with free metallic oxides, than when it was present as arseniate or antimoniate of silver. The reason of this is, that the sulphate of silver is decomposed and reduced to metallic silver before either of the other salts, and more particularly before the arseniate, although their behavior at a high temperature is not altogether the same, as the antimoniate of silver is very rapidly decomposed, the other two salts more slowly.

With regard to the second part of this question, in what condition is the silver volatilized? The following experiments on the small scale were instituted by the author:—

1. 3 grms. of silver, in a minute state of division, were carefully mixed in a glass mortar with an equal volume of finely powdered quartz; this mixture was introduced into a glass tube $\frac{1}{2}$ an inch wide, and about 20 inches long, of difficultly fusible glass. And after that part of the tube which contained the mixture had been enveloped with platinum foil in order to ensure a more uniform application of the heat, it was raised by means of a spirit-lamp to a moderate red heat (incipient *strong calcining* heat), while from a gasometer a current of dry hydrogen gas was passed slowly over it. Although this experiment was prolonged for upwards of an hour, not the slightest appearance of volatilization of the silver could be perceived. 2. An experiment conducted in the same manner with carbonic oxide, led to the same result. But 3, when a similar mixture was treated with oxygen gas, there quickly appeared in the neighborhood of the mixture, towards the open end of the tube, a slight, dull, grayish-white coating, which gradually increased, and extended about an inch along the tube; afterwards that portion of the coating nearest to the mixture was converted into a shining, annular, metallic crust. At the conclusion of the experiment, which like the former ones was carried on for an hour, a portion of the sublimate was removed, and on rubbing it in an agate mortar was found to be metallic silver, and this was confirmed by testing in the wet way. The part of the glass tube where the mixture had rested was found to be stained of a light to a dark yellow by oxide of silver, both above and below, and a

little to the right and left of it. 4. A mixture of finely divided silver and ignited oxide of zinc, treated in the same manner with oxygen gas, gave in general the same results; the metallic coating, however, was not quite so striking; the tube also was found to be colored yellow by oxide of silver where the mixture had rested.

From the results of the above experiments we may draw the conclusion, that that portion of the silver which in addition to that carried off as flue-dust escapes during an oxidizing roasting, is removed, not in the metallic state, but at a certain temperature commencing at a low red heat, as oxide of silver, which afterwards, in its free state and at a low temperature, is again reduced to metallic silver; but as it then exists in such an extremely minute state of division, it becomes mixed with the gaseous products of the combustion of the fuel, and also the gases and vapors resulting from the oxidation of the ores, and is readily carried away with them into the atmosphere.—*Berg-und hüttenmann Zeitung*, 1855, No. 35.

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*On Antimonial Vermilion.** By E. Mathieu-Plessy.

The author has invented a process which furnishes antimonial vermilion of a beautiful color, and which is sufficiently simple to be employed in its preparation on the large scale.

Hyposulphite of soda is best prepared by the action of sulphur upon sulphite of soda; it is not usually allowed to crystallize. The sulphite of soda must be in the neutral state to avoid the action of the sulphurous acid upon the hyposulphite. The sulphite of soda is most simply and cheaply prepared in the following manner, recommended by Camille Köchlin. In the upper part of a vessel, the bottom of which is broken out, a sieve containing large crystals of carbonate of soda is fixed. Into the lower part of the vessel projects a furnace pipe bent at right angles, which is attached to a small clay furnace. Into this furnace sulphur is thrown by little and little, and burns into sulphurous acid, which passes through the tube into the vessel, and there acts upon the carbonate of soda. The combustion of the sulphur may be regulated as occasion requires through the door of the furnace; the draft is quite sufficient, and in the course of three or four days the crystals of carbonate of soda are acted upon to a considerable depth. The very friable sulphite of soda may be readily separated from the unaltered nucleus if any remains, and the latter may then be put back into the sieve. The sulphite of soda is dissolved in water so as to produce a solution of 25° B., and this is saturated whilst hot with crystallized carbonate of soda. When effervescence no longer occurs on the addition of this salt (which is the best criterion, as litmus paper gives no satisfactory indications), or rather when the dilute sulphite furnishes a slight effervescence of carbonic acid on the addition of muriatic acid, flowers of sulphur are added, and the mixture is heated in an earthen vessel for three hours on the water-bath, stirring and replacing the water that evaporates. When the fluid is cool, it is filtered and diluted until it shows 25° B.

Perchloride of antimony is prepared by heating powdered black sul-

* From the Lond. Chem. Gaz., No. 322.

phuret of antimony with commercial muriatic acid. When the evolution of sulphuretted hydrogen begins to diminish at a gentle heat, the mixture is boiled for a few minutes. On cooling, the clear liquid is decanted. To avoid inconvenience from the sulphuretted hydrogen gas evolved during the solution of the sulphuret of antimony, it may either be passed into a solution of soda, or allowed to pass through a tube drawn out to a point at the extremity, close to which the flame of a spirit-lamp is placed; by this the sulphuretted hydrogen is burnt, even when it is mixed with much aqueous vapor. The solution of chloride of antimony obtained is diluted with water to 25° B.

When the solutions of hyposulphite of soda and chloride of antimony are thus prepared, the antimonial vermilion is prepared in the following manner:—4 litres of solution of chloride of antimony, and 6 litres of water are poured into a stoneware basin, and after these, 10 litres of the solution of hyposulphite of soda. The precipitate which is produced by the water is rapidly dissolved by the hyposulphite of soda in the cold. The basin is now placed in a water-bath, which is heated to boiling; in this the temperature of the mixture gradually rises. Towards 86° F. the precipitate begins to form; it is at first orange-yellow, but gradually becomes darker. The temperature is allowed to rise to 131° F., when the basin is removed from the water-bath, and the precipitate is allowed to settle, which takes place rapidly. The fluid is separated from the precipitate by decantation; the precipitate is washed first with water containing one-fifteenth of muriatic acid, and afterwards with common water, then collected on a filter and dried. In the moist state the antimonial vermilion has a shining red color, but in drying it loses a little of its lustre. It was also produced in the cold, but the process described is more certain, and furnishes a finer color.

The author has analyzed the antimonial vermilion thus prepared, and at the same time examined the amount of water in the ordinary orange-red sulphuret of antimony (precipitated by sulphuretted hydrogen). 0·668 grm. of the latter lost 0·038 grm. in weight when heated to 392° F.; 0·808 grm. of antimonial vermilion showed a loss of 0·009 grm. when heated to the same temperature. The latter might be attributed entirely to hygroscopic water, and the antimonial vermilion may therefore contain no chemically combined water. The loss of weight which the orange-red sulphuret of antimony undergoes shows, on the contrary, that this contains water chemically combined, and this loss of weight gives it the composition $SbS^3 + HO$. The further analysis of the antimonial vermilion was effected by treating a weighed quantity of it with nitromuriatic acid containing an excess of nitric acid. A portion of sulphur remained undissolved, which, after tartaric acid had been mixed with the fluid, and the latter had been diluted with water, was separated, dried, and weighed. The fluid contained the remainder of the sulphur in the form of sulphuric acid, which was determined by precipitation with chloride of barium. The antimony was merely determined from the loss. The result of the analysis was, that the antimonial vermilion consists of 1·1 per cent. of water, 26·7 per cent. of sulphur, and 72·2 per cent. of antimony. As the water is to be regarded as non-essential, it appears that the compound consists entirely of sulphur and antimony. —*Polytechn. Centralbl.*, 1855, p. 1451.

*On the Manufacture of Crown and Sheet Glass.**

Read before the Society of Arts, &c.

A table of crown glass of to-day would scarcely recognise as of kindred origin a table of the earlier part of the present century. The principle of the process in each case was the same: it is the improvement of minute details that produces so different a result. To Mr. Hartley and Mr. Chance, who, during the years 1832 to 1836, gave to the manufacture of this glass their constant attention, is owing, in a great measure, its present status.

When the tables of crown glass are drawn from the kiln, they are covered with a whitish film or "hum." The history of this hum is curious. It arose, probably, in the first instance, from the deposition of sulphur from the fuel upon the surface of the glass. It thus became associated with the process of annealing, and buyers fancied that the more hum there was upon the glass, the better was the glass annealed. The manufacturers of crown glass, ever ready to accommodate themselves to the fancies of their customers, have taken the trouble to produce an additional hum, by the introduction of sulphur in the kiln. The members, however, of the Glass Jury of the Paris Exhibition, not being in the secret of this hum, stoutly maintained that glass thus clouded must be bad glass, and that the hum was owing to the exudation of the alkali.

In the warehouse, the tables are laid upon a "nest," or cushion, and are divided, by the diamond of the splitter, into two unequal parts, the larger half containing the "bull's-eye." The diameter of the table is measured on the nest, the usual size being now about 54 inches, and weighing 13 lbs. Tables have been made as wide as 70 inches, but the difficulty of manipulation, and the uncertainty of the result, render such sizes too costly to be general.

The splitter carefully examines each table before splitting it, and turns it round till he has brought it into the position in which he may split it to the best advantage, announcing at the same time its quality. The first quality is called "best"—*rara avis in terris*, the next seconds, then thirds, fourths, cc, ccc, or Irish, and tables containing any very glaring defects come under the denomination of "coarse."

These variations in quality depend on the presence or absence, number, and extent of those defects to which, even in the best regulated manufactories, glass is unavoidably liable. Perhaps the glass has been badly melted, and is seedy,—full, that is, of little vesicles, to which the rotary motion has given a circular shape; or, the gatherer may have enclosed air within his "metal," and a gatherer's blister is the result, or a pipe blister, or pipe-scales, or dust from the pipe-nose, or dust from the marver, or dust from the bottoming-hole, or dust from the nose-hole, or dust from the flashing furnace, or bad bullions, or scratches, or music lines, may disfigure the table; or the glass may be crizzled, or curved, or bent, or hard, or smoky, or small and light,—defects to explain which, would be a long and dreary task. No wonder that tables of the best quality are few and far between, in some manufactories a forlorn hope never to be realized.

* From the Lond. Builder, No. 687.

The difficulty of obtaining glass free from defects will account for what may at first astonish,—the fact that the value of a table of the highest quality is three times that of the lowest.

The defects enumerated, many as they are, are instantly detected, even through the obscuring hum, by the splitter, who not only can descry faults invisible to ordinary eyes, but can refer each fault to a particular stage of the process, and to a particular cause in that particular stage, and the faults are registered accordingly. The nomenclature of defects is much facilitated by the mapping out of the table into certain ideal divisions, derived from shapes assumed during various periods of the process. The centre lump is termed the bullion: round this lies the bottom; next the bulge; the shoulder, the top, and the rim, or the outermost edge of the circle.

Independently, however, of these defects, there are certain other disadvantages under which even a faultless table of crown glass must unavoidably labor. The cutting of a circle into rectangular sheets must necessarily be attended with waste, while the bull's-eye confines those sheets to comparatively small sizes. Uniformity of thickness, also, except by the most skilful manipulation, is difficult of attainment. Wavy lines, termed music lines, forming a series of concentric circles round the bull's-eye, and owing to the treatment of the glass upon the marver, were formerly a common defect; but improvements in the process have in a great measure removed them.

On the other hand, extreme brilliancy of surface is a distinguishing characteristic of this glass, ascribed by some to the influence of the marver, by others to the effect of the flashing-furnace.

It is this brilliancy of surface which has enabled crown glass to maintain in England its position against that formidable rival of which I must now briefly speak.

Imagine, as before, a lump of glass collected upon the end of the gatherer's pipe. For the metallic table or marver is now substituted a block of wood, so hollowed out as to allow the lump, when placed upon it, to be expanded by the blower to the diameter ultimately required. The block, during this operation, is sprinkled with water, to prevent the wood from being burnt, and from scratching the glass. From the block it is carried to the blowing furnace, which is accessible through a number of holes or openings, each hole being allotted to a single blower. In front of the furnace corresponding to each opening is a stage or frame of wood, erected over a large pit or well about 10 feet deep, and these parallel stages are sufficiently apart to enable each blower to swing his pipe to and fro in a vertical plane, that the glass may run freely out, as the phrase is, to the required length. When the glass has been sufficiently heated in the blowing furnace, it is brought out, and swung round in a vertical plane, and also backwards and forwards; and the blower, at the same time, by blowing down the pipe, constantly keeps the lengthening cylinder full of air.

Uniformity of substance and of diameter is chiefly secured by the skill of the workman, who, when he finds the metal running out too freely, holds the cylinder vertically above his head, still keeping it well filled

with air. These operations are continued until the cylinder has reached the length required. The diameter of the cylinder was determined by the wooden block, and remains the same throughout.

The next stage of the process is opening the end of the cylinder. The thinner kinds of glass are all opened by submitting the end of the cylinder to the fire, and at the same time forcing in air through the pipe and stopping up its aperture. The air is expanded by the heat of the fire, and bursts open the cylinder at the end; this being the hottest and most yielding part. The aperture thus made is widened out to the diameter of the cylinder, by subsequently turning the cylinder to and fro with the opening downwards.

The thicker kinds are opened by attaching a lump of hot glass to the end of the cylinder, which thus becomes the hottest and weakest part, and the air forced in by the blower as before, bursts it open. The opening is then enlarged by cutting round it with scissors. If opened in the furnace, as in the first case, the ends of the thicker cylinders would be so thinned out that a considerable portion would be wasted.

The cylinder is now laid on a wooden rest, or "chevalet," and is easily detached from the pipe by the application of a piece of cold iron or steel to the neck of the glass near the pipe-nose: the neck being hot suddenly contracts externally and breaks away from the cylinder. There still remains the cap or end of the cylinder, which is easily taken off by wrapping around the end of the cylinder a thread of hot glass, removing the thread, and applying a piece of cold iron to any point which the thread covered.

On the continent, the operation of heating the glass cylinder is performed in the apertures of the melting furnace; but the obvious advantage of a separate furnace has induced, I believe, one French manufacturer to adopt the English plan, and others will probably follow his example.

The cylinder, as it now lies upon the chevalet, is little more in weight than two-thirds of the lump of glass which the gatherer collected on his pipe. The quantity left upon the pipe-nose, with that which formed the cap of the cylinder, are nearly equivalent in weight to one-half the cylinder.

The finished cylinder is now split open by a diamond, which, attached to a long handle, and guided by a wooden rule, is drawn along the inside length of the cylinder, and should pass through or in the neighborhood of some notable defect or groupe of defects, if such be present,—for defects thus brought to the edges of the subsequent plate of glass are of lessened injury to its value. An object to be avoided is the black mark which the cylinder sometimes receives from the charring of the wooden "chevalet," on which, while hot, it rested in the glass-house. If the diamond passes inside the cylinder, over the space occupied by this mark upon the outside, the cylinder will fly to pieces. The reason of this is not difficult to understand. The chevalet prevented, by its non conducting tendency, that portion of the glass in which it was in contact, from cooling equably with the rest, and the particles at that point remained in a state of tension. A careful blower will never place any large defect in

his cylinder in contact with the chevalet, being aware of the probable result.

The use of the diamond in dividing plain surfaces of glass, dates from the sixteenth century; but its application to the splitting of cylinders which h adnot undergone the process of annealing, was introduced not more than twenty years ago by M. Claudet. Previously, all such cylinders were split by a red hot iron, and, even now, all cylinders of flashed glass, that is, of ordinary sheet glass covered inside with a skin of colored, are still split in the same fashion.

On the continent, I believe, the diamond is gradually replacing the use of red hot iron, though the latter is still the method more generally practised.

The cylinder is now ready for the flattener, who, having prepared it by a preliminary warming in the flue, by which it is introduced into his furnace, passes it, by means of a croppie, or iron instrument, on to the flattening stone, from the slight irregularities of whose surface it is protected by a lagre, or sheet of glass, laid upon the stone. Upon this lagre the cylinder, lying with the split uppermost, is soon opened by the flame passing over it, and falls back into a wavy sheet. The flattener now applies another instrument, a polissoir, or rod of iron, furnished at the end with a block of wood, and rubs down the waviness into a flat surface, often, upon a refractory piece, using considerable force. Some cylinders are so distorted in the blowing that no rubbing can flatten them; but all, good, bad, and indifferent, pass through the same treatment. The flattening stone is now moved on wheels to a cooler portion of the furnace, and by the aid of the flattening fork, delivers its sheet to another stone, called the cooling stone. From this, when sufficiently stiff, it is again lifted, and then piled generally on its edge, in order to be annealed.

Very different, both in process and result, was the manufacture of spread, or German cylinder glass, which preceded the introduction into England of the French system. The cylinder, unskilfully blown, was cut open while hot with a pair of shears, and spread out immediately upon a plate of iron, covered with sand. The thickness of this glass was very irregular, and its surface very coarse.

(To be continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 21, 1856.

John Agnew, Vice-President, in the chair.
John F. Frazer, Treasurer.
Isaac B. Garrigues, Recording Secretary.
The minutes of the last meeting were read and approved.
Letters were read from the Royal Geographical Society of London.

Donations to the Library were presented from the Royal Geographical Society, and the Geological Society of London; The School of Mines, Paris, France; The Austrian Engineers' Society, Vienna; Hon. Richard Brodhead, U. S. Senate; M. Lewis Clark, Esq., St. Louis, Missouri; The Mercantile Library Association, Boston, Mass.; The Regents of the University of the State of New York, Albany, N. Y.; and from Messrs. Parry & M'Millan, Lindsay & Blakiston, and Ayres Stockly, Philadelphia.

Mr. R. A. Wilder, Engineer of the Mine Hill and Schuylkill Haven Railroad, presented to the Cabinet three slabs of Sandstone, deeply indented with ripple marks, from a quarry in the second mountain at the Gap of West Branch of Schuylkill.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of July.

The Board of Managers and Standing Committees reported their minutes.

On motion, the Committee on Exhibitions were instructed to take the necessary steps to hold an Exhibition of American Manufactures next Fall, agreeably to their recommendation this evening.

Candidates for membership in the Institute (5) were proposed, and the candidates proposed at the last meeting (4) were duly elected.

Mr. Howson exhibited a model of an improved ice boat, for which a patent was granted on the 5th of August last, to Messrs. H. and W. Brown. The invention consists in constructing a steamboat with a recess at the bows; the bottom of the recess consisting of two inclined shelves, one on each side, and divided by an angular rib, tapering upwards from the bows, and terminating with a curve under the deck; the end of the recess forming an angle, the sides of which also taper towards the bows of the boat.

In connexion with the above is a guard on each side, suspended from, and secured to the deck. The whole arrangement is for the purpose of breaking the ice, and directing the broken pieces underneath the body of the ice that remains unbroken on each side of the boat, thus forming a clear channel for the passage of sailing and other vessels.

A correct description, with illustrations of the above invention, will be given in a future number of this *Journal.*

Mr. H., also, exhibited a machine for cutting the kernels of green or boiled corn from the cob, for which a patent was granted to W. B. Coates, of this City, in May last. A full description with engraving of this useful apparatus, will be found in the present number, page 197.

A safety or detective envelope, for which a patent was granted to the same inventor on August 5th, was also exhibited by Mr. Howson.

It consists of an extra lap or turn-down, which by adhesive matter is secured to the enclosed letter, so that any attempt to abstract the contents of the envelope by cutting the edges of the same, may be at once detected.

This invention will also be illustrated and described in a future number of this *Journal.*

COMMITTEE ON SCIENCE AND THE ARTS.

Report on an Improvement in Feed Apparatus, Invented by Jacob Frick, of Philadelphia.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "the Improvement in Feed-Apparatus," invented by Jacob Frick, of Philadelphia—REPORT:

That it consists of a check valve, blow-off valve, and safety-feed valve, with an alarm apparatus attached, each having its own distinct chamber, and all contained in one compact instrument. The check valve is of the usual puppet kind; the blow-off valve is a three-way cock whose passages complete the communication between the boiler and check valve chamber, when the feed-water is passing into the boiler, or between the blow-off pipe and the boiler when the latter is being emptied. The safety-feed valve is the same as used heretofore, with a lever bearing upon the valve, and weighted to give a rather greater pressure per sq. inch than is had in the boiler, and which, by rising when the communication between it and the boiler is closed, permits the water to pass away through the waste pipe.

The alarm apparatus is operated by the waste water passing through a cylindrical chamber, in which slides a piston valve that is forced downwards by the pressure of the water, until several grooves cut in the wall of the chamber, parallel with its axis, are uncovered sufficiently to allow the water to pass through them and beyond the piston, and re-enter the chamber and pass away through a pipe attached to it. When the return stroke of the feed pump relieves the valve of the water pressure, it rises by the action of a spring coiled around its spindle, and thus vibrates a bell, which may be placed in any part of the engine room, or in the office, and notify the attendant or proprietor when the supply to the boiler is cut off.

The Committee commend the inventor for the ingenuity shown in the arrangement of the various parts ordinarily used for the purposes set forth, and for the excellence of the workmanship of the model, and consider that when a cock is interposed between the check valve and the boiler, it would be useful, by preventing the bursting of the feed pipes, if the communication should become closed by the shutting of the cock or obstructions in the pipe.

The single attachment (although much used on the cylinder boilers of stationary engines,) cannot be considered an advantage; for, if the supply water be impure, the blow-off pipe should be attached to that part of the boiler where its contents are most quiescent, as the foreign particles always tend to such a place, and subside; this can never be near the attachment of the supply pipe, even though at a point where by the disposition of the fire surface the ebullition is least; for the current of entering water will prevent any matter from settling near it.

By order of the Committee,

Philadelphia, August 14th, 1856. WILLIAM HAMILTON, *Actuary.*

Description. By H. Howson.

This invention consists in the combining together in one instrument of a check valve, stop valve, and blow-off valve for steam boilers, in such a manner that the whole may be secured to the boiler by one attachment only, thereby avoiding the necessity of piercing and wounding the boiler in several places for the purpose of making the separate and distinct attachments hitherto employed for the same purpose ; it further consists in employing in connexion with the above combination of valves and cocks, a safety valve, and alarm apparatus, fully described hereafter, for the purpose of notifying the attendant engineer when any undue obstruction is offered to the regular flow of water from the feed pump to the boiler.

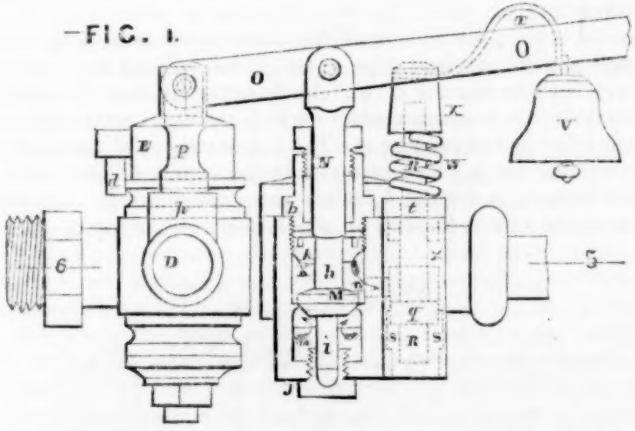
On reference to the annexed illustrations—

Fig. 1, Is an elevation (partly in section on the line 1—2, fig. 3).
Fig. 2, A sectional elevation of the same on the line 3—4, fig. 3.
Fig. 3, A sectional plan on the line 5—6, fig. 1.

The same letters of reference allude to similar parts throughout the several views.

A, is the chest containing the check valve, and B, the casing of the combined stop and blow-off cock. Cast to, and projecting at right angles to each other from the casing B, are the hollow projections, C and D, the

FIG. 1.

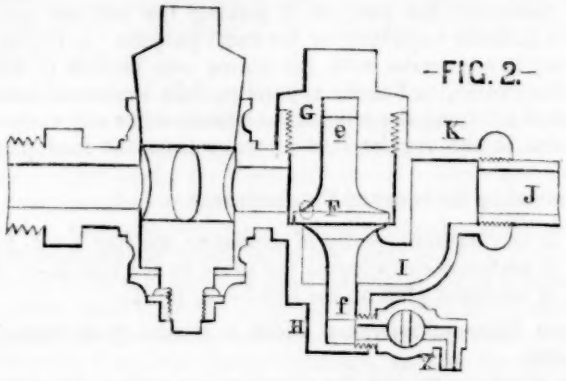


former screwing into, and communicating with the steam boiler, and the latter forming the blow-off passage. E, is the plug of the stop and blow-off cock, having one opening *a*, directly through it, and another opening *b*, communicating with *a* at right angles.

These openings are so arranged that when the plug is turned to the position shown in fig. 3, there is a direct communication from the check valve through the opening *a*, and through the interior of C to the boiler, but when turned in the direction of the arrow, so that the opening *b*,

coincides with the interior of the projection c, the passage from the check valve is stopped, and a communication opened between the boiler and the blow-off passage D. The top of the plug E, is furnished with a projection *d*, which strikes against projections on the top of the casing B, and prevents the said plug from being turned to any other positions than

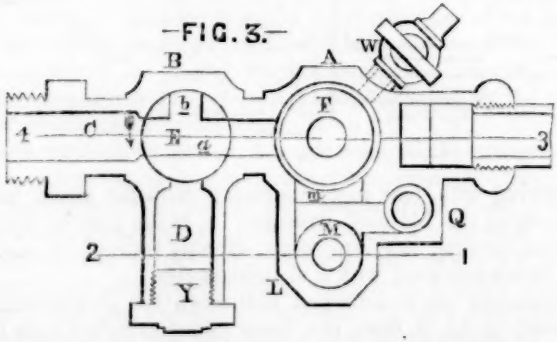
-FIG. 2.-



the two above described. F, is the check valve operating and having its seat in the chest A, the upper stem *e* of the valve moving in an orifice in the cover G of the chest, and the lower stem *f*, moving in the opening of the projection H.

Below the valve, the interior of the chest communicates by the curved passage I, with the feed pipe J, which screws into the hollow projection K. To the chest A of the check valve, is cast the chest L, of the safety valve M, below the seat of which the two chests communicate with each other by the passage *m*. The lower stem *i*, of the safety valve M, moves in the nut *j*, which screws into the bottom of the chest L, and the upper stem *h*, in the nut *k*, below the stuffing box *t*. Through the latter passes the rod N, the end of which bears on the top of the stem *h*

-FIG. 3.-



of the safety valve, its upper end being jointed to the lever O, which has its fulcrum on the stud P, the latter being screwed into a projection *p*, on the blow-off passage D.

Cast or otherwise secured to the chests A and L, is another chest Q, the lower part of which is bored out for the reception of the piston *q*, on the rod R. Above the piston *q*, the interior of the chest Q, communicates by the passage *n*, with the space between the valve M, and nut *k*, in the chest L.

The interior of the chest Q, in which the piston *q* operates, has several grooves S, the top of which are covered by the piston when the latter is at rest, but when moved downward by the action (hereafter described), a passage is formed from the space in the chest L, above the valve M, through the passage *n*, and down the groove S, through the bottom of the chest Q. The latter is furnished at the top with a stuffing box *t*, through which passes the piston rod R.

This rod is furnished at the top with a nut *w*, between which and the top of the stuffing box gland *t*, intervenes a spiral spring *w*, which has a tendency to keep the piston *q*, with its rod in the position shown in fig. 1, when not otherwise depressed.

In order to prevent the piston rising too high, the rod is furnished with projections *x*, which fit against the shoulder in the chest Q.

To the top of the nut *w*, is attached a spring T, furnished at the end with a bell, or the top of the piston rod R, may be connected by means of wires to any other suitable alarm apparatus within the hearing of the attendant engineer.

W, is a cock for discharging any water which may collect in the chest A, above the check valve F and X, a similar cock for drawing the water which may collect below the valve, in the projection H. Y is a plug which always remains screwed into the end of the projection D, as long as the latter is not used for blowing-off from the boiler.

The plug E, of the stop and blow-off cock being in the position shown in fig. 3, and the lever O, weighted to suit the pressure in the boiler, against which the water has to be forced; a communication exists from the feed pumps through the pipe J, attached to the same; through the seat of the check valve F (which operates according to the action of the pump in the usual manner), and the plug E, of the stop and blow-off cock to the boiler. Should the plug have been turned accidentally or otherwise, so as to obstruct the passage of the feed water to the boiler, the pump of the engine being still in operation; the excessive pressure occasioned by this obstruction, and the action of the pump combined, will cause the water to act on the underside of the safety valve M, and raising the latter will pass through the opening *n*, to the space in the chest Q, above the piston *q*, passing down the latter until a portion of the water can escape down the grooves S, and at the same time causing the bell to ring. During the time the feed pump takes its upward stroke, this excessive pressure will cease, and the spiral spring *w*, will raise the piston *q*, to its former position, but immediately the down stroke commences, the depression of the piston takes place, and the alarm continues until the engineer either regulates the pump or the plug E, of the stop and blow-off cock. When the latter has to be used for blowing-off the boiler, the plug Y is removed, and a bent or other pipe directed to an adjacent drain or sewer screwed into its place, the plug E, is then

turned until its opening *b*, coincides with the passage through the projection c, to the boiler, when a blow-off passage is immediately formed. When used as a stop cock only, for obstructing the feed water from the boiler, the plug Y is retained in the position shown in fig. 3.

Report on Hoard's Gas Regulator.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was refered for examination a "Gas Regulator," invented by Mr. J. W. Hoard, of Providence, Rhode Island—REPORT:

That the regulator under consideration consists of a cylindrical box, divided into two cylindrical compartments by a diaphragm; in the centre of the diaphragm is a circular opening, fitted with a conoidal valve. In the centre of the cover of the upper cylinder, is fixed a tube projecting upwards, and having a screw cut on its inner surface; a nut with an outside thread is so arranged as to move up or down in the cylinder by turning it with a screw-driver reached into the tube; to the bottom side of this nut is secured one end of a spiral spring, the other end of which is attached to the valve. In the bottom of the lower cylinder, there is a narrow annulus for the reception of mercury.

Within the lower cylinder is fitted a small gas holder, the top of which is attached to the bottom of the valve, the lower edge of the holder is inserted into the mercury seal.

An opening is made through the end of the lower cylinder beneath the gas holder, so as to secure atmospheric pressure upon the inside of the holder.

The gas inlet communicates with the upper portion of the regulator (above the diaphragm), and the outlet is placed on the side of the lower cylinder. The position of parts is such that the pressure of the street main is exerted upon the upper side of the valve tending to close it, and the burner pressure influences the lower side of the valve, and the top of the small gas-holders, whilst the interior of the gas-holder is subjected to atmospheric pressure constantly. The spiral spring transfers the weight of the valve and holder to the nut in the tube, and by screwing the nut up or down in the tube, the burner pressure can be increased or diminished at pleasure.

In the experimental trials upon this regulator, the inlet was connected with the street main by a service provided with a stop-cock, with which to vary the street pressure, and a pressure gauge was placed between the stop-cock and the regulator. To the outlet was connected a branched pipe with 24 outlets, one of these was provided with a pressure gauge, the remainder with burners.

The average results of several trials on two individual regulators was as follows:

With a street pressure of ·35, and with 22 lights burning, the burner pressure was adjusted to ·5—20 lights were then extinguished when the burner pressure rose to ·6.

The following table exhibits the results under a varying pressure on the street main, with few and with many lights.

Pressure on Inlet to regulator in inches of water.	Pressure on Outlet to regulator; 2 burners lit, in inches of water.	Pressure on Outlet to regulator, 22 burners lit, in inches of water.
4·	0·5	0·5
3·5	+0·5	0·6
3·—	0·6	0·7
2·5	0·65	0·75
2·—	0·7	+0·8
1·5	+0 8	0·9
1·—	0 8	—0·9
0·75	—0·75	—0·7 supply insufficient.
0·5	—0·5 supply insufficient.	—0·4

An examination of these results shows, that as the street (or supply) pressure diminished, the burner pressure increased, until the supply became insufficient for the wants of the burners; at which point the burner pressure was exceeded by the street pressure, by the amount of friction produced by passing the regulator.

The cause of this over compensation may be traced as follows: The variations of pressure upon the inlet, produce corresponding variations of pressure upon the back of the valve; as the street pressure increases the valve should close, and in doing so, increase the tension of the spring by such quantity as exactly to balance the increased pressure upon the valve. The results obtained show that the tension of the spring was insufficient at high pressures upon the inlet, and too great at low pressures. In the one extreme the regulator throttled the flow, and in the other permitted too free a passage.

Although this instrument approximates to the results desired, it cannot be declared to be a perfect regulator. Such an one should maintain a constant outlet pressure, unaffected by change in consumption, or variations of supply.

By order of the Committee,

Philadelphia, August 14, 1856. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICES.

The Art of Perfumery, and method of obtaining the Odors of Plants, with instructions for the manufacture of perfumes for the handkerchief, scented powders, perfumed soap, &c.; with an Appendix on the colors of flowers, artificial fruit, &c., &c. By G. W. SEPTIMUS PIESSE. Philadelphia: Lindsay & Blakiston, 1856.

This is a very interesting little memoir on the art of perfumery, including within its range the preparation of all toilet articles, such as scented soap, tooth powders, cosmetics, hair-dyes, &c., &c. It contains a brief description of the processes for obtaining the odoriferous prin-